Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.
Published by McGraw Publishing Company, Inc.

Vol. 65 NEW YORK, SATURDAY, MAY 15, 1915 No. 20

Service Always First

THE new commissioner of the New York Public Service Commission, Second District, Mr. J. O. Carr, spoke with understanding last week to the members of the Empire State Gas & Electric Association and the Eastern New York Section of the National Electric Light Association. An account of the joint meeting is published in this issue. One of the things which Mr. Carr, just stepping from a utility company to public office, took occasion to emphasize is that the public should receive the service to which it is entitled regardless of the rate of return earned on the company investment. Another way of stating this very general truth is that the company shall give service first and look for a return only as a secondary consideration. This spirit animates the electric central-station industry in an extraordinary degree. Service is the definite aim of those in charge of the operation of the equipment. Without service there is no revenue for the owners. Service is the tangible result of the physical structure and organization of employees, while return is the slowly accumulating residue far in the background, and even lost to the sight of most of the workers. To justify the company in continuing in business the return exists, otherwise capital could not be hired to take the risk of investment and, because of these economic conditions, the service desired would not be available.

Increase in Maximum Rate in Missouri

AFTER consideration of the effect of reduced rates at Kirksville for six months the Missouri Public Service Commission has allowed a readjustment of the schedule in order to overcome increased operating expenses. The "readjustment" involves an increase in maximum rate for residence lighting. That the commission appears to have some doubt as to the economy of the management of the property is not so important as is the fact that, in spite of its impression, it authorizes an increase in the maximum unit of revenue. That is to say, the commission evidently does not regard the possibilities for economy as controlling but it does hold that more revenue is essential. For a commission to admit publicly that the facts did not develop in complete accordance with its forecast requires political courage. If a commission cannot accept the truth of changing conditions, its functions might better be abolished. In the more conspicuous cases of steam railroad rates and the Milwaukee electric railway fare case the Interstate Commerce Commission and the Railroad Commission of Wisconsin, both older bodies than the Missouri regulating authority, recognized frankly the justice of altered positions. The Missouri commission prevented adverse conditions from running to extreme length by permitting a change after so short a test as six months.

Central Stations Show Gains

CENTRAL stations reporting to the ELECTRICAL WORLD for February, 1915, showed gains of 2 per cent in income, as compared with the income for February, 1914, and 2.2 per cent in the output of electrical energy in kilowatt-hours. The percentage of gain in income is only one-half of the gain in January, but the increase in the output of energy in February is a little larger than the increase in January. While the changes are so slight and the totals so great that experiences of individual properties are obscured, the plain inference of the statistics is that the market for lower-priced energy for industrial uses has improved. The statistics published elsewhere in this issue will repay careful study in detail. Although the returns by groups of states indicate varying conditions, the combined operations for the whole United States, so far as it is covered by the reporting companies, show that in February we were still on substantially the level that had prevailed since last October, and still a little above the corresponding periods twelve months earlier.

Women Stockholders

IN their movement to protect the Cincinnati Gas & Electric Company against oppressive rates the stockholders give statistics showing the distribution of stock ownership. Of the 8166 shareholders, 4370, or 53.5 per cent, are women. Women hold 39.7 per cent of the total stock. Cincinnati holders have 74.4 per cent of the total stock, 15 per cent is estimated to be owned by residents of small communities within the Cincinnati "metropolitan area," and 10 per cent is held by more distant non-residents. This disclosure shows the city that policies detrimental to the company will be detrimental to the welfare of many residents. Over one-half of the stock held in the city is owned by women, and the extent to which their rights are entitled to serious consideration is a problem that the officials cannot fairly ignore. It is not necessary for the community to constitute itself guardian for women investors, but when it takes rate-making powers from the companies it deprives them of a means of protection without giving a compensatory substitute. If it does not legally guarantee security holders against loss, its representatives should at least give all reasonable protection and consideration under ordinary circumstances to jeopardized interests.

Electricity in Mining Service

A very complete and interesting account of the working of an important transmission system on the South African Mining Rand was given in a paper by Mr. J. H. Rider read before the (British) Institution of Electrical Engineers. As our readers doubtless know, in the Transvaal there are several important transmission systems, including one from Victoria Falls, but the one here concerned is probably the largest steam-driven transmission plant in the world. The source of energy in this case is cheap coal utilized in great turbo-generators. Somewhat more than $15,000,000 has been invested in the enterprise, and the annual amount of energy supplied by it is 310,000,000 kw-hr., on a maximum demand of 47,300 kw, at a load-factor of 0.75. Electrical energy has been adopted for most of the mechanical operations in the Rand mines except rock drilling, which is done by compressed air supplied in the main from central stations, many of which are electrically driven. The total rating of the 1500 motors supplied with energy by the transmission system under consideration amounts to 142,300 hp, so that the average motor is a fairly large one.

In addition to the important details of the plant, Mr. Rider's paper contains a valuable account of the peculiar problems encountered and the difficulties faced and overcome in the operation of mining machinery on a large scale under conditions unfamiliar to most engineers. Most of the hoisting is now done electrically and to a considerable extent by induction motors, the Ward Leonard system of control, however, being used in some of the largest and most important installations. Most of the three-phase motors used were employed in changing over the hoisting gear from steam to electric drive, although a number of entirely new three-phase hoists are now in service. As a rule the motors are controlled by liquid rheostats in which there is a certain amount of automatic regulation of the height of the liquid in the tanks, in order suitably to regulate the speed of the hoist without depending wholly upon the operator.

Some remarkably instructive details are given by Mr. Rider concerning troubles in design found in various apparatus supplied to the mines. It must be borne in mind in the first place that mine work is carried on for the most part twenty-four hours per day and all the year round, so that all machines must be designed with due regard to the probability of extreme wear and tear and, in the electrical equipment, to the fact that the air cooling of the machines is limited because the Rand is at an elevation of about 6000 ft. and hence is about 5.5 in. subnormal in barometric pressure. Among the common troubles noted by Mr. Rider are faults in the induction motors, lack of stiffness in the stator frame being the most troublesome item. Moreover, it has been found that for the sake of gaining a little extra in power-factor many of the motors have been made with too small air-gaps considering the stiffness of the frame. In some instances rotors 6 ft. in diameter were operated with a radial air-gap of only 1 mm, a condition quite sufficient to insure serious trouble.

Mr. Rider called particular attention to the fact that in working a large distribution system of motors where the supply voltage is permitted to vary either way by 10 per cent from the normal it is absolutely necessary to rate the motors for continuous operation at the lower voltage limit. Failure to realize the necessity for liberal rating has caused no inconsiderable amount of trouble in the supply of energy on the Rand both for the motors and, during the earlier stages of operation, for the generators, of which there was an insufficient reserve considering the heavy loads that had to be carried at times. A good many valuable lessons in motor driving of mining machinery may be learned from Mr. Rider's paper, which has the rare merit of being based directly on the author's long personal experience on the Rand.

The Havana Generating Station

In the new Havana generating station described in this issue is found another instance of intelligent consolidation work in electrical supply. Three old stations have been replaced by a single new and efficient one, designed with reference to the future needs of the system. The new station, which has to carry practically the entire electrical load of Havana, has been in full operation since the end of last year. It now contains three 12,500-kw turbo-generators with all the auxiliary apparatus necessary for the complete electric service of the city. These generating units are supplied with steam from a battery of twenty-four horizontal water-tube boilers with superheaters. Both the boiler and the generator units seem of comparatively modest individual rating, but in considering the station the fact had to be faced that any single piece weighing more than 20 tons could be transported only with extreme difficulty and at very great added expense.

The turbo-generators deliver energy at 2350 volts, the pressure being raised by transformers to 13,200 volts for distribution. This somewhat unusual practice is easily explicable by reference to local conditions. It was desired to distribute energy from the new station at 13,200 volts in order economically to cover the distances which might be necessary. The compromise pressure of 6000 volts which was considered seemed to possess no particular advantages for the generators and to involve disadvantages in the distribution because of the higher cost. In selecting between 2300 volts and 13,000 volts for the generators, ordinary practice would indicate the latter, but on account of the climate of Havana, with its normally high humidity, the distance from the base of supplies and the trouble in obtaining engineers familiar with high-tension generators, the lower voltage was selected on the principle of "safety first." A break-down in the higher voltage winding might mean serious delays in placing the machine back into operation. At 2300 volts there is less likelihood of break-down, and repairs are easy to execute.

Large fuel storage supply is necessary because all coal must be imported, and it is convenient to be able to purchase the coal in considerable quantities. The

ordinary bunkers hold about 3000 tons, and there is storage space in the yard for 6000 tons more, or, if necessary, even double this amount. Use is made of New River coal since it has been found that the transportation cost makes low-grade coal dear at any price. Water for condensing purposes is obtained by a double canal reaching the harbor and provided with elaborate inlet screens to keep inconvenient foreign matter, largely jellyfish, out of the circulating water. The detailed description is worth careful reading, relating as it does to a very good example of the adaptation of means to ends under somewhat unusual conditions.

Annual Dues of Engineering Societies

The development of a technical society is a process which normally pursues a fairly well-defined course, as has been manifested by the histories of many such societies formed during the last half century. Ordinarily the first step is for a small number of men, associated in a certain field of engineering work and within easy traveling distance of some town, to meet voluntarily for the discussion of technical matters in mutual interest. These reunions foster the sense of intellectual class feeling. They also stimulate the desire to solve shared problems and overcome technical difficulties encountered in common. The next step is to incorporate a society with an advertised office, permanent staff, meeting hall and program. This procedure involves very considerable expense, so that means must be found for financing the undertaking. In some cases a few altruistic individuals or institutions come forward and offer to assume a certain share of the expense. This is more frequently and markedly the case when the work to which the society is devoted enrols a comparatively small number of workers who could not be expected to afford a proportionate share of the annual operating expense if this devolved entirely on the membership. Thus societies engaged in pure or unapplied science are frequently aided by endowment. They may have their secretarial work voluntarily done below normal cost by college teachers, or their meeting halls may be provided below cost by endowed scientific institutions, or their publication costs may be assumed in whole or in part by existing scientific bodies having money to spare.

As the development of an engineering society proceeds its membership list increases, and the desire increases for the full publication and distribution of the papers read. At the same time, the members and their board of directors seek to avoid becoming regularly under financial obligations to industrial corporations. They feel, as they grow up, that they ought to acquire independence of industrial aid. The expense of publishing and distributing papers steadily increases also, while the publishing expenses per member tend to rise, in spite of the increasing number of members. Under these conditions the managers have to decide upon the society's financial policy. If the annual membership fee is fixed at $5, experience has shown that, without considerable external support, the publication must be greatly curtailed. For example, it is shown to be possible to keep a scientific society in existence on a membership-dues basis of $3 annually. In that case, however, only very few of the papers presented can be printed and circulated. Ordinarily, the printed list of papers read at conventions before a three-dollar society is equivalent to a list of "hic jacet" burial notices. Only those who are able to attend the convention and witness the funeral ceremonies of the papers can learn what they contain.

In order to print, circulate and publish, in regular volume form, the papers of an active engineering society, the annual budget must apparently amount to about $8 per member, in the absence of external support. The next step, therefore, in the regular development of such a society, is to increase the average annual dues. It is usually impracticable to obtain a vote of the membership in favor of doubling the dues, so it is customary to add a new and advanced class of membership, say, at $10 per annum, with certain exclusive rights and privileges pertaining thereto, in order that a sufficient number of the members may be induced to apply for the advanced membership; while no existing privileges are withdrawn from those members who may desire to remain in their original five-dollar classification.

The Illuminating Engineering Society seems now to have arrived at the stage of development where a new class of advanced and more expensive membership becomes necessary in order to meet the costs of publication. This society was founded in 1906, with five-dollar annual dues. It holds an annual convention and sustains half a dozen local sections in various parts of the country. It not only prints and distributes annual proceedings of great technical value, but it also prints many of the papers for circulation in advance of the meetings. It has hitherto succeeded in meeting its expenses with the aid of external support from the industries. It now seeks to rely financially upon its membership dues, and for that purpose to create a new class of "members" with ten-dollar dues, the existing class being called for distinction "associate members." Privileges to be enjoyed by the proposed new members are, first, that officers of the society can be drawn only from their class, and, second, that only those who may be either professionally or notably connected with illuminating engineering are eligible for the advanced membership, so that a certain amount of professional prestige pertains thereto.

The question of introducing these amendments into the constitution is being submitted to the existing members of the Illuminating Engineering Society for a vote. If it is voted to adopt the new plan, the excellent work of the society, as it is at present being conducted, will probably be continued on a self-supporting basis. If, on the other hand, the new plan is not adopted in the ballot, the society must either continue to be partly dependent upon external industrial support or it must limit its publications to those of a five-dollar society, with correspondingly numerous burials of papers.

LETTERS TO THE EDITOR

"Catastrophe" Reserve for Central Stations

To the Editor of the ELECTRICAL WORLD:

SIR:—Discussing further the editorial on "Storm Losses" in the issue of the ELECTRICAL WORLD of April 17, the writer would add that in urging this matter of a "reserve" he has been met continually by the rejoinder that all, or very nearly all, "catastrophes" of the character mentioned in his letter in your issue of May 1, 1915, were insurable through the various types and kinds of insurance companies in America or abroad. It was also argued that therefore, from a protective standpoint, such a "catastrophe reserve" was not needful for the insured, and also that the premiums on such insurance would be so much less per annum than any reasonable amount that should be laid by annually for such reserve that it would be unnecessary to make the public pay the additional amount needed to form the reserve.

This is only partly true. In the end these losses have to be paid by someone, or by some collection of people, and while, as in the case of general fire losses, it might be deemed best for certain reasons to make these distributive over a large area instead of being limited to the particular area damaged, there seem to the writer to be more favoring reasons for the reserve than for the insurance.

The first reason in favor of the reserve is that it can be made a certainty. This is not true of insurance, which is a contract between two parties of opposing interests, a contract having many complex conditions and limitations, the infraction of any one or any few of which may vitiate the terms in whole or in part to the great detriment of the amount insured.

The second reason is that the amount of the reserve accumulated at the time of need can be made available for use instantly, and very often instant availability is an important factor in the prompt rehabilitation of the property and the cost thereof. Even in case of no dispute under the insurance plan, there is always more or less delay in obtaining the funds, and where there is any dispute it tends, together with the negotiations or legal proceedings, to delay further the receipt of the agreed or adjudicated amount.

The third reason is that the reserve method conduces to more economical results for both public and utility. The insurance method means expenses—"overhead expenses," if nothing else—from which the reserve method is free, and it also means, as a rule, a profit to someone or some class, whereas the reserve method can be operated at absolute net cost.

It is also well to consider that should the formation of such a reserve finally become universal practice, as events seem to indicate that it will, the distributive factor of the insurance plan becomes of less and lessening importance as the reserve practice becomes general.

The above three points of certainty, instant availability and economy are very strong reasons for the adoption of the "reserve method" as against the "insurance method" of taking care of all uncontrollable, fortuitous and specifically unforeseeable risks in public utility business.

It is true that, within the above limitations, the insurance method is available immediately for the full amount estimated as needed in each case, while the reserve will have to be built up gradually and may take years before it reaches the desired amount and that within those years the catastrophe may happen. But there is nothing to prevent the use of both methods in the beginning, with the insured amount lessening year by year as the reserve amount grows. The "reserve" is simply individual insurance without commercial profit to anyone and, surrounded by the proper legal restrictions and protections similar to those of insurance funds in many states, it has peculiar financial, commercial and social advantages over the insurance method.

H. S. COOPER,
Secretary Southwestern Electrical and Gas Association.

Dallas, Tex.

Complexion and Lighting Effects

To the Editor of the ELECTRICAL WORLD:

SIR:—In the report of my lecture before the Chicago Section of the Illuminating Engineering Society which appeared on page 1141 of your issue of May 1, 1915, a slight typographical error rendered ambiguous or questionable one of the statements with which I was credited. The sentence was as follows: "Light coming strongly from one direction produces sharp shadows which bring out wrinkles and also makes the complexion appear hard." If the word "harsh" be substituted for "hard," the meaning which I intended to convey in my lecture will be expressed.

While on the subject the writer wishes to take advantage of the opportunity to disclaim before the readers of the ELECTRICAL WORLD some of the absurd statements with which he has been credited at various times during the past few years by certain sensation-loving editors of Sunday newspaper supplements concerning the effects of light on the beauty and sanity of unfortunate mortals who may be subjected to light of the wrong color. Joking aside, however, and relegating to the scrap heap all of the erroneous and amusing misquotations referred to, there are a few points along the line of color of light, shadows and diffused character of lighting which every one must bear in mind to design intelligently the lighting for interiors where the pleasing appearance of faces under the illumination provided is of importance. It may provoke laughter to talk of specular reflection from human skin, but the phenomenon is very real nevertheless. Where light is largely unidirectional—that is, where it comes from a small bright source of light with insufficient diffused lighting to modify it—minute patches of skin reflect light by specular reflection to such an extent that the appearance is decidedly less pleasing than when the lighting is so well diffused as to suppress specular reflection. Added to this effect with strongly unidirectional lighting there is another, even more disquieting to the fair sex. The shadows will cause any incipient wrinkles to be brought out prominently. For the foregoing reasons both direction and diffusion are important if the lighting effects are to be pleasant. These effects were forcibly impressed on the writer a number of years ago in a room so equipped that different systems of lighting could be alternately switched on and off in order that the instantaneous changes could be noted. The effect of one of these systems (and a common one at that) was immediately to create a harsh appearance of the skin as compared with the effect of a more diffuse system.

Another problem to be reckoned with in this connection is that of color. This problem very largely solves itself in electrically lighted rooms where use is made of incandescent lamps in any of the forms yet devised, because the light from such lamps is sufficiently yellow to bring out in a pleasing way the rosy tints in complexions. The same cannot be said of many rooms

lighted with gas mantle burners. In the opinion of some, it will be necessary to exercise care in the future in the use of gas-filled tungsten lamps where the most pleasing color effects are desired, and in some cases to modify the light of such lamps to give a more yellow hue. The writer is not one of those who believe this will be necessary in many cases, but the condition must not be forgotten because of the occasional installations where it must be considered. Of course, if the gas-filled tungsten lamp is to be used indiscriminately and unshaded, in total disregard of the eyesight, some unpleasant complexion effects will probably be produced, with the general aggregate of bad results with such a combination; but where proper attention is given to the shading of the lamps and diffusion of the light the methods used to secure diffusion make it easy to give the necessary yellow tint to the light if thought necessary.

J. R. CRAVATH,
Chicago, Ill. *Consulting Engineer.*

Indexing of Electrical Engineering Subjects

To the Editor of the ELECTRICAL WORLD:

SIR:—In your editorial on "Indexing of Electrical Engineering Subjects," in your issue of April 24, you refer to the inadequateness of the Dewey decimal system of classification. It is true that the actual Dewey classification with its many decimal digits would be unsuitable for an engineering data collection, yet the Dewey system itself is admirably adapted for such a classification.

I have in use quite a respectable array of data sheets, the result of many years' collection. With many thousands of data sheets comprised in my collection, I have not found it necessary to go beyond four figures. Thus, data on "dynamo-electric machinery" include numbers 8000 to 8099, being classed as the first subdivision, 80, of the main division 8, "Electrical Engineering." The subject 80 is divided into ten divisions, 800 to 809, according to the various classes of dynamo-electric machines, and under each class ten more subdivisions, such as 8000 to 8009 or 8090 to 8099, go into the detailed information about that class.

All my data are either written or pasted on specially printed sheets, 4 in. by 6 in., or they are folded to this size and, after numbering, are filed in card-index boxes 11 in. long, each holding from 1000 to 1500 data sheets. On the printed sheets spaces are provided for the number, title and reference to source.

I have also prepared an "Alphabetical Index to Subjects," in which all imaginable subjects are entered with their classification number, thus serving as a time-saver in numbering data sheets for filing.

New York City. ALFRED E. WIENER.

To the Editor of the ELECTRICAL WORLD:

SIR:—It is doubtless a fact that the Dewey decimal system of classification as it is commonly used is not so well adapted as it might be for electrical-engineering data classification. At the same time, if properly extended, it can be made to satisfy admirably all practical requirements for indexing in this profession. The great advantage accruing through the use of the Dewey system is that an electrical-engineering library or a collection of engineering data indexed in accordance with it will automatically form a unit of any library, which may cover the entire range of human knowledge, provided that library is indexed by the Dewey system.

In other words, if one uses the Dewey system he can classify all his data and literature—engineering or otherwise—in accordance with one logical, comprehensive system.

Some time ago the writer had occasion to classify his own library and collection of engineering data, which, while not large relatively, covers a wide range of electrical and other subjects. In seeking a system of classification, he was referred to the booklet "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," issued by the University of Illinois Engineering Experiment Station. The extension of the Dewey decimal system as given in this booklet for engineering data was found to be well fitted for all requirements. The writer's library has been indexed in accordance with the University of Illinois system, and all of his notes and data will be ultimately. The booklet referred to is certainly invaluable to any engineer who desires a systematic scheme of classification for his notes, data and books.

St. Louis, Mo. TERRELL CROFT.

Proposed National Electrical Safety Code

To the Editor of the ELECTRICAL WORLD:

SIR:—As I have just received the advance copy of the proposed national electrical code, it is impossible for me to discuss it intelligently in detail at this time. Let it be stated, however, that we have been in close touch with the Bureau of Standards in Washington during the compilation of the code. In fact, the Workmen's Compensation Service Bureau had commenced compiling such a safety code on its own initiative, but in view of the desirability of uniformity we deferred to the wishes of the Bureau of Standards in delaying the publication of our data until that bureau should be ready to report. Our engineers have co-operated with the Bureau of Standards for the last six or eight months.

The necessity of a uniform national safety code, taking into consideration the factor of safety to life as well as to property, has been apparent to us for years past. The fact that workmen's compensation laws are rapidly displacing employers' liability laws made the need imperative. Rating schedules for workmen's compensation in electric central stations and distributing plants had to be compiled, and such schedules cannot possibly be made scientific unless a common standard of safety in construction and operation is agreed upon. As a matter of self-protection, the electric-light companies should insist upon this also. Their rate for compensation insurance is predicated on the accident frequency over the entire classification. Prevention work is not carried on with equal persistency by all electric-light companies, and the result is that under the present system of rating some of them are paying too much where others are paying too little. With a uniform national safety code and with proper charges for deviations in equipment from that code, each plant will be made to carry its proportionate share of the average in relation to the whole, and the plant coming nearest to the standard or having exerted the greatest effort for the prevention of accidents will receive the lowest rate of insurance.

It is my feeling that the Bureau of Standards is to be congratulated on its efforts, and it is earnestly to be hoped that it may receive the hearty co-operation of the operators as it has received such co-operation from the National Fire Protection Association and the Workmen's Compensation Service Bureau. With the fire underwriters and casualty underwriters in accord as to what shall constitute standard equipment, I believe that it is in the ultimate interest of the central-station companies that they adopt the same standards for their guidance.

CARL M. HANSEN,
New York, N. Y. *Secretary Workmen's Compensation Service Bureau.*

Franklin Medal to Edison

At a meeting to be held at the Franklin Institute in Philadelphia on the evening of May 19 the Franklin Medal will be presented to Mr. Thomas A. Edison. The Franklin Medal will also be presented to Chevalier van Rappard, on behalf of the Netherlands government, for Prof. Heike Kamerlingh Onnes. The sculptor's model of the Franklin Medal will be presented to Mr. Samuel Insull. On this occasion Mr. Insull will make an address on "Electricity and Modern Industrial Growth."

The Franklin Medal is awarded annually from the Franklin Medal Fund, founded Jan. 1, 1914, by Mr. Samuel Insull, to those workers in physical science or technology, without regard to country, whose efforts, in the opinion of the Institute, acting through its committee on science and the arts, have done most to advance the knowledge of physical science or its applications.

Edison Medal to Bell

At a meeting of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, New York, on May 18 at 8:15 p.m., the Edison Medal will be presented to Dr. Alexander Graham Bell for the invention of the telephone. The presentation address will be made by Mr. John J. Carty, chief engineer of the American Telephone & Telegraph Company. An address on "How Bell Invented the Telephone" will then be delivered by Mr. Thomas A. Watson, who was associated with Dr. Bell in the early development of the telephone.

Preceding the presentation exercises, the report of the board of directors of the Institute for the fiscal year ended April 30, 1915, will be read, and the committee of tellers will present the report on the result of the election of officers for the coming administrative year.

Edison Honored as World Benefactor

An audience which completely filled Carnegie Hall, New York, attended the formal presentation of the Civic Forum medal of honor for distinguished public service to Mr. Thomas A. Edison on May 6.

In his introductory remarks Chairman Nicholas Murray Butler, president of Columbia University, stated that the medal is awarded for distinguished services and great scientific achievement and in recognition of a great career, which has a place among the highest in the roll of human history.

Following the reading of a poem on Edison by its author, Mr. Percy Mackaye, Hon. John Franklin Fort, former Governor of New Jersey, discussed Edison the man. He remarked that while Edison lives in New Jersey and is a citizen of the United States, he belongs to the world.

Dr. William Marconi expressed the opinion that Edison is even more highly thought of in Europe than in America.

To Edison were attributed by Hon. George McAneny, acting Mayor of New York City, those inventions which rendered possible the building of our great cities.

President Richard C. Maclaurin of the Massachusetts Institute of Technology held that the educational world, particularly the schools of technology, is under special obligations to Edison, who more than any one else in this country has taught men to see something of what science can do. His influence must remain a permanent source of inspiration both within the schools and without.

Dr. Charles P. Steinmetz characterized Edison as "the genius, the man of peace." Mr. Charles A. Coffin referred to his "charming human qualities." Dr. John A. Brashear told of his early association with Edison, and paid a high tribute to Mrs. Edison, declaring that the achievements of many great men of the country are due largely to the encouragement of their wives.

Letters and telegrams which were read to the audience and then presented to Mr. Edison were received from President Wilson, ex-President Taft, ex-President Roosevelt, Dr. Alexander Graham Bell, Dr. Charles W. Eliot, Dr. Arthur T. Hadley, Governor Frank B. Willis of Ohio, Cardinal Gibbons, Prof. Elihu Thomson and Mr. Andrew Carnegie.

Meeting of the N. E. L. A. Executive Committee

The meeting of the executive committee of the National Electric Light Association held at the headquarters in New York on May 7 was attended by many. The following were present: Messrs. Holton H. Scott, president; Douglass Burnett, W. C. L. Eglin, A. C. Einstein, L. D. Gibbs, W. E. Long, J. B. McCall, H. A. Holdrege, Walter Neumuller, R. S. Orr, E. W. Lloyd, Paul Spencer, H. A. Wagner, W. F. Wells, T. C. Martin, secretary; S. A. Sewall, assistant to the secretary, and also, by invitation, Messrs. G. W. Elliott, H. M. Edwards and W. H. Blood, Jr.

Mr. Burnett, as chairman of the Commercial Section, informed the committee that the Central Station Institute of Chicago has offered the section the use of lectures prepared for the Institute to be incorporated in the correspondence course for salesmen which the section expects to issue. The terms offered by the Institute were acceptable to the Commercial Section executive committee, and Mr. Burnett asked the executive committee of the main body for permission to make an agreement. The committee approved the arrangement suggested.

Secretary Martin read the membership report as of April 30, 1915, showing the following: Class A members, 1113; class B, 10,805; class C, 90; class D, 251; class E, 791; foreign, 39; total, 13,089. Applications were read and approved for the following new members: Class A, 31; class B, 1156; class D, 6; class E, 34; foreign, 4. The following class C memberships were approved: Prof. Arthur L. Cook, Pratt Institute, Brooklyn, N. Y.; Prof. W. D. Peaslee, Oregon Agricultural College, Corvallis, Ore.; Mr. A. Jackson Marshall, secretary of the Electric Vehicle Association of America; Mr. J. E. Latta, Underwriters' Laboratories, Inc., Chicago, Ill.

Permission to form company sections was granted to the Rumford Falls Light & Water Company of Rumford, Maine, and the Erie (Pa.) Lighting Company.

A letter was read by Mr. Martin, addressed to President Scott, from Mr. I. Fujioka, of Tokio, Japan, announcing the death of Mr. S. Yashima, who was elected to honorary membership at the fifth convention of the association. The secretary was directed to send resolutions to the family of Mr. Yashima expressing the regret of the association.

President Scott told the committee that the question of the relations of the association with the Bureau of Standards had been referred to the public policy committee, and that a special sub-committee has been appointed, of which Mr. Wagner is chairman. Mr. Wagner discussed the plan of the Bureau of Standards to prepare rules relating to practically all branches of the electrical industry covering safety of operation for apparatus and lines, and also installation and construction. Mr. Wagner added that the association, together

with other interested associations, has been invited to participate in a conference with the bureau in Washington on July 1 and 2. Each association is to have three representatives, and Mr. W. H. Blood, Jr., has been appointed chairman of the N. E. L. A. committee of three for this purpose. The members of the executive committee approved the proposal that the association be represented at the conference and assist in formulating the rules.

Mr. Edwards, as chairman of the accounting committee, spoke of letters from member companies referring to the provision in the standard system of accounts that sinking-fund payments be charged against income. The letters asked that these payments be deducted as appropriations rather than as charges against income. The accounting committee agreed to this change, and an amendment to the standard system of accounts providing therefor will be offered at the convention.

Secretary Martin made an extended statement concerning preparations for the convention. Forty papers and reports are already in the hands of the printers. They aggregate over 1200 pages of printed material, and probably another 150 pages will be added to this total, making it perhaps the largest amount of convention material prepared in advance in any year. As a proper hall could not be secured for the public policy meeting, scheduled for the evening of June 9 at San Francisco, that meeting has been postponed to the evening of Thursday, June 10, when it will be held in the Native Sons' Hall.

Mr. Martin said further that Mr. John A. Britton, chairman of the local convention committee, has arranged with President Moore of the Panama-Pacific Exposition to make Thursday, June 10, N. E. L. A. day at the Exposition, with special exercises in the afternoon. These will probably include a guard of honor and a band to meet the visiting delegates at one of the main gates and a march to the Festival Hall, where there will be a reception by the Exposition officials, an organ recital, and possibly some remarks. The chief intention, however, is that the delegates shall disperse after the exercises and, at the invitation of the N. E. L. A. exhibition committee, visit the various electrical exhibits. It is also proposed to supplement these features by special illumination and fireworks in honor of the association on the evening of Friday, June 11. The local California companies and the committees are planning to erect in honor of the association a decorative arch in Union Square opposite the Hotel St. Francis.

Mr. Martin added that the Jovian Order will cooperate as usual with the N. E. L. A. during the week, especially on Thursday, June 10. There will be a Jovian night on June 8. The details of the various special features of this character will be worked out during the present month.

Passengers on the "Lusitania"

A number of persons known in the electrical industry were on the steamship *Lusitania*, which was torpedoed and sunk by a German submarine off the coast of Ireland on May 7. Dr. F. S. Pearson, president of the Pearson Engineering Corporation, had been in this country for two months and was returning to England with Mrs. Pearson. The body of Dr. Pearson was found after the sinking of the ship, and Mrs. Pearson is reported as missing.

Mr. Isaac B. Trumbull, secretary and treasurer of the Connecticut Electric Manufacturing Company of Plainville, Conn., lost his life on the *Lusitania*. Mr. John B. Trumbull, president of the company, announced that the death of his brother had led him and his other brothers to decide to go into the business of manufacturing munitions of war. In the past the company has refused to take orders for rifle parts and shrapnel. Mr. A. J. Byington, of Sao Paulo, Brazil, representative of the Westinghouse Electric & Manufacturing Company in southern Brazil, who was on his way to England after a trip to this country, was on the *Lusitania*, but is reported among those saved. Mr. E. B. Tootal, a partner in the banking house of Ellis & Company of London, who had been in this country with some of his associates to go over the properties of Henry L. Doherty & Company, in which they are largely interested, was also on the steamer, but escaped with his life. Mr. Edwin M. Collis, an employee in the treasury department of the Commonwealth Edison Company of Chicago, was on his way to England to collect a legacy; after clinging to a piece of wreckage in the water for two hours he was rescued and cabled his family in Chicago that he was safe. Mr. Elbert Hubbard, editor of the *Philistine*, who has addressed meetings of the Jovians and other electrical gatherings many times, and Mrs. Hubbard lost their lives.

Manufacturers and Central-Station Service

Increase in popularity of central-station service among manufacturers was discussed by Mr. H. H. Holding, general power representative of the Public Service Electric Company of Newark, N. J., before the National Electric Light Association Company Section recently. The subject of Mr. Holding's paper was "Why the Manufacturer Prefers to Use Central-Station Power." The increased popularity of central-station service, Mr. Holding said, has been a surprise to promoters of private-plant apparatus and engineers of generating plants. Unfortunately central-station new-business departments have not fully appreciated the situation themselves. The probable underlying reason for decisions favorable to the central station on the part of the manufacturer has often been overlooked, and it has not been used as a selling argument by the central-station salesman as often as occasion would warrant. The accompanying table gives figures taken from the United States Census reports on the status of manufacturing industries.

In ten years the total value in dollars of manufactures increased 80 per cent, Mr. Holding showed. The capital invested in manufacturing industries, however, increased 105 per cent. As a result earnings upon capital invested decreased 30 per cent. Had it been found possible to increase the capital required in direct proportion to the increase in value of product, the decrease in the return for capital invested would have been less than 10 per cent. In ten years the manufacturer decreased greatly the number of laborers or wage-earners, but the wages of such employees increased so as practically to balance the effect of the reduced number. Much of the increase in capital undoubtedly has been for the purpose of increasing the efficiency of manufacture by the introduction of modern tools and methods of handling material.

Analyzing the energy requirements, it is discovered that electric drive in 1899 was only 5½ per cent of the total, in 1904 12.6 per cent, and in 1909 25 per cent. The part, therefore, which electric transmission of energy within the factory has played in this shifting condition in the industrial arts is quite obvious. If it were possible to give authentic figures up to the present time, the ascending curve of the application of the electric motor, Mr. Holding said, would undoubtedly show a high percentage. A recent census by the Public Service Electric Company indicates that electric drive is utilized to the extent of 46 per cent of the entire energy used in the territory.

As in many instances cost of energy is only a small

proportion of the total cost of product manufactured, a great amount of capital should not be invested permanently for energy purposes. As the manufacturer invests his money for the returns from such investment, Mr. Holding continued, his reasoning, promoted and supported by the financial interests involved, would be along the line indicated as follows:

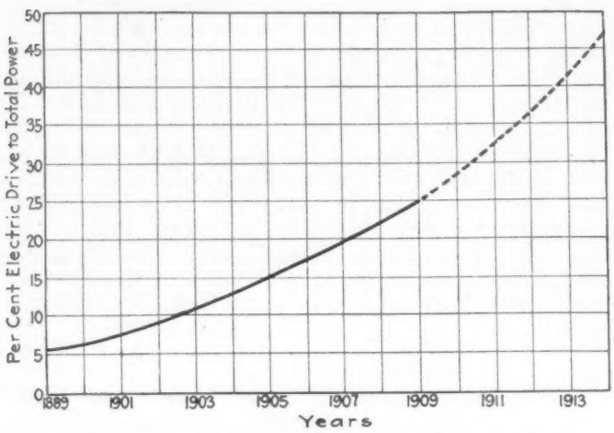


FIG. 1—RATE OF ADOPTION OF ELECTRIC DRIVE

Generally speaking, return for invested capital is in proportion to the risk involved. Investment in a gold mine may promise tremendous return, but the security of the principal so invested is indeterminate because the lead may end at any moment. Investment in government bonds has national credit as a basis and is therefore very secure but gives a very low rate of return. Between these two limits there is a broad field for investment, and within this field lies investment in industrial art.

CENSUS STATISTICS OF MANUFACTURERS, ALL INDUSTRIES—UNITED STATES

	1899	1909
Number of establishments	207,514	268,491
Employees:		
Salaried employees	364,120	790,267
Wage earners (average number)	4,712,763	6,615,046
Total employees	5,076,883	7,405,313
Rating (in horse-power) of engines owned:		
Steam	8,139,579	14,199,339
Gas	134,742	751,186
Water	1,454,112	1,822,888
Electric	310,374	*3,068,109
Other	49,985	29,293
Total	9,778,418	16,802,706
Rating (in horse-power) of motors using purchased energy:		
Electric	182,562	1,749,031
Other	136,913	123,639
Total	319,475	1,872,670
Total engine rating	10,097,893	18,675,376
Capital	$8,975,256,000	$18,428,270,000
Expenses:		
Services—Salaries	$380,771,000	$938,575,000
Wages	2,008,361,000	3,427,038,000
Cost of materials†	6,575,851,000	12,142,791,000
Miscellaneous	905,442,000	1,945,686,000
Total expenses	9,870,425,000	18,454,090,000
Value of products	11,406,927,000	20,672,052,000
Value added by manufacture	4,831,076,000	8,529,261,000

	1899	1904	1909
Rating of engines owned:			
Electric horse-power	*310,374	*1,150,886	*3,068,109
Rating of motors using purchased energy:			
Electric horse-power	182,562	441,589	1,749,031
Total using purchased energy	319,475	632,902	1,872,670
Total engine rating	10,097,893	13,487,707	18,675,376

*Electric motors using energy generated by the establishments themselves to avoid duplication are excluded from the total.
†Including cost of energy.

Having in mind that part of the investment necessary for a private electric generating plant, the risk of such investment depends upon the condition of business, cost of operation, changes in manufacturing processes, change in national policy and money supply.

The history of the country indicates that business, especially along manufacturing lines, is variable; there are some years of plenty and some lean years. This fact is illustrated, said Mr. Holding, by the kilowatt-hour curve of the company for 1914 showing by months the kilowatt-hours used for industrial energy. The average condition, then, should not be judged by the study of a prosperous period.

Cost of operation is increasing gradually because of the increased cost of fuel, labor, repairs and incidentals. There seems to be no indication of decrease in the near future.

Scientific study is changing manufacturing. The change of operation may have a decided effect on the energy required and therefore upon the source thereof. This is illustrated by the experience of the rubber industry during the last two years.

Greater or less success of an industrial venture depends to some extent upon its relation to the world's competition. The tendency is for this country to enter more and more into competition with the world at large.

Periods when it is difficult to obtain money for industrial investment come very frequently. Borrowing depends upon security. Investment in "fixed plant" is regarded by bankers as a poor basis of credit as it is not quickly negotiable. Therefore all money spent for generating plant impairs credit. Many a manufacturing business has been sacrificed because of inability to raise needed funds quickly.

As a single instance, it is estimated that if ready capital should be used to obtain an average saving of 2 per cent per month for cash buying, discounting of bills, stocking of material, etc., at the end of a year a net earning of 26.8 per cent will be shown.

With such a process of reasoning, Mr. Holding contended, it is not to be wondered that the manufacturer should decide to save investment in a private generating plant, even though the kilowatt-hour cost, as determined by his consulting engineer, should be much higher for purchased energy. Where the manufacturer has to solve the problem of providing energy he will call for expert advice, and if he is a wise investor, he will undoubtedly also give very careful consideration before he decides upon the expenditure of any great amount of money. In making an estimate of the probable cost per kilowatt-hour in a factory plant the engineer must assume a set of conditions. The conditions assumed are obtained from the data furnished by the manufacturer.

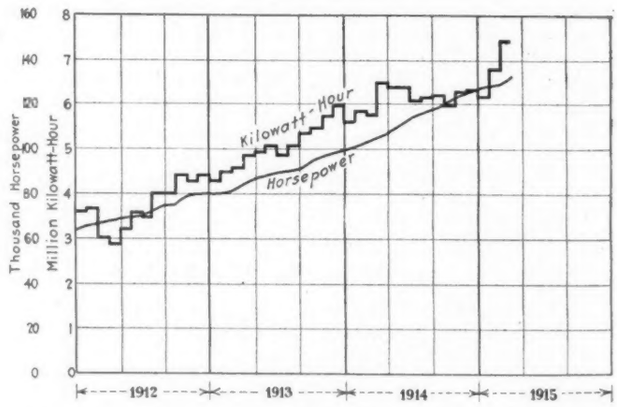
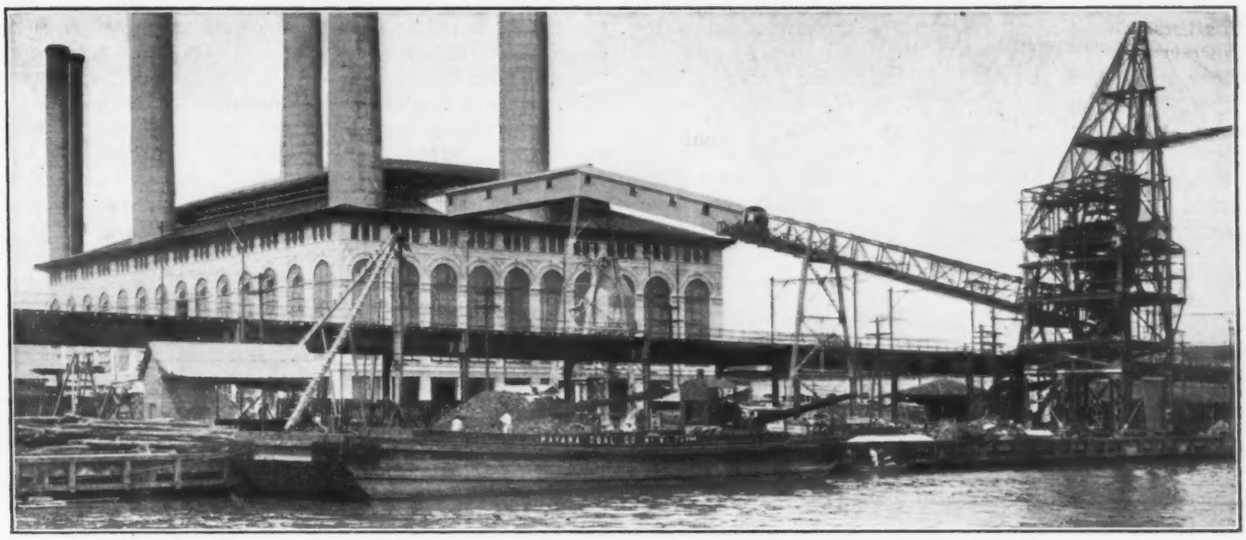


FIG. 2—COMPARISON OF HORSE-POWER AND KILOWATT-HOUR PRODUCTION



New Power Station for City of Havana

Description of Installation That Replaces Three Former Plants of Electric Company Serving the Cuban Capital

By C. W. Ricker*

THE consolidation of the Havana Electric Company and the Havana Gas & Electric Company some two years ago made it evident that a new electric generating plant should be built to take the place of the three old and inadequate power stations then in operation. The new station was needed not only to reduce the cost of producing energy, which alone would have fully warranted the investment, but, what is more important, to meet the constantly increasing need for electrical energy in the company's many and varied activities.

In consequence a contract for equipment was made early in February, 1913, with the Westinghouse Electric & Manufacturing Company. This covered three 12,500-kw turbo-generators, together with condensers, boiler-feed pumps, automatic stokers, exciters, transformers, electrical switch gear and control apparatus, the limited capacity of each generating unit being due to the fact that no single piece exceeding 100,000 lb. in shipping weight could be transported without excessive difficulty and expense. Shortly after placing this order a contract was made with the Babcock & Wilcox Company to furnish and install twenty-four 6000-sq. ft., horizontal water-tube boilers with internal Foster superheaters, and with the selection of the principal features of apparatus the plans for the power-house building were rapidly developed, work being begun on the foundations on March 17, 1913.

The first of the generating units was started on Oct. 1, 1914, and began to carry load regularly on Oct. 3. On Dec. 1, 1914, two main units were in regular operation, and the old plant, which had supplied the larger portion of the lighting and commercial motor loads, was finally shut down. On Dec. 11 the third generating unit was put into regular operation, and on Dec. 31 all of the railway load was transferred to the new station, with the exception of that which was to be carried by a new substation then under construction.

In general the new station is divided into three sections or panels, each consisting of one generating unit complete with its condenser, condenser pumps, boilers and connecting piping. The general auxiliaries for the station, consisting of exciters, boiler-feed pumps, plant-service and heater-supply pumps, feed-water heaters and meters, constitute a fourth group. This is installed between the second and third of the main units. The steam piping of the three sections is connected by an equalizer or tie-line header, to which the auxiliary group is connected so that the general auxiliaries may be supplied with steam directly from any section or sections of the boiler plant in operation. All condenser pumps and general auxiliaries are steam-driven and they exhaust into a bank of open feed-water heaters.

As the only water available for boiler feed must be purchased from the city water supply system at a very high price and is heavily charged with scale-forming matter, it is important to save all the condensate possible and to keep it free from oil. Consequently, all auxiliaries are turbine-driven except the three house-service pumps, the stoker engines and a few small pumps. These exhaust through oil separators, and in this way only a very small part of the steam condensed in the main feed-water heaters or the condensers ever comes in contact with cylinder oil. The only known losses of water evaporated in the boilers are due to leakage from pipe and boiler joints and the steam blown into the stoker grates.

The steam piping was laid out in accordance with the general plan of three main sections and an auxiliary section all tied together by an equalizer or tie-line header with sectionalizing valves. This general scheme is followed also in the exhaust piping of the auxiliaries, the drain piping and the circulating-water system of the main condensers. The drainage of the high-pressure steam piping flows through groups of traps which discharge to the main heaters, and the low-pressure drains flow to the outside water service.

Owing to a city ordinance which forbids the connection of pumps which draw water directly from the city main, a storage tank has been provided outside the

*Assistant general manager Havana Electric Railway, Light & Power Company.

building into which water flows under normal pressure. For this the pit of an old gas holder formerly used by the gas department was repaired and covered and another similar pit is under construction. The combined capacity of the two pits will be about fifteen days' supply of water for the make-up and for general plant service with the present equipment fully loaded. If the plant is operated non-condensing, however, the supply would last for only a few hours. All rain water from roofs and other clean surfaces will flow into the storage tanks.

This large fresh-water supply is of great importance, as the city water is subject to variation of pressure and even to occasional interruptions which in the past have threatened the constancy of service very seriously. In addition, if the plant had to run non-condensing under heavy load for even a few minutes, the flow from the city pipes would be quite inadequate to supply water to the boilers.

Electrical Equipment

The electrical characteristics of main generators were selected on the basis of the various systems of distribution already in use, such matters as climate, character of available station labor and distance from the base of supplies being also considered. Energy is distributed to the railway substations at 13,200 volts by aerial lead-covered cable. About three-fifths of the energy for the lamps and motor loads is transmitted at 2200 volts by overhead single-wire lines, while two-fifths is transmitted at 6000 volts by underground lead-covered cables. All of the three systems are three phase-operated at a frequency of sixty cycles. While both the lighting and the motor service systems cover the whole city, the greater part of the load in the vicinity of the plants is transmitted at 220 volts.

The determination of the generator voltage was based upon the fact that 6000 volts offers no advantages as compared with 13,200 volts and has the disadvantage of much higher copper cost. This left the choice between 2200 volts and 13,200 volts, both being entirely practicable for the generators purchased, but mainly on account of the constant high humidity and also the distance in both space and time from the base of supplies and the difficulty in getting station attendants in Cuba who were used to such high-tension winding, the lower of the two voltages was selected. This involved some serious difficulty due to the great size of the generator leads and generator circuit-breakers, but these objections were considered easier to overcome, under the circumstances, than the local difficulties with high tension.

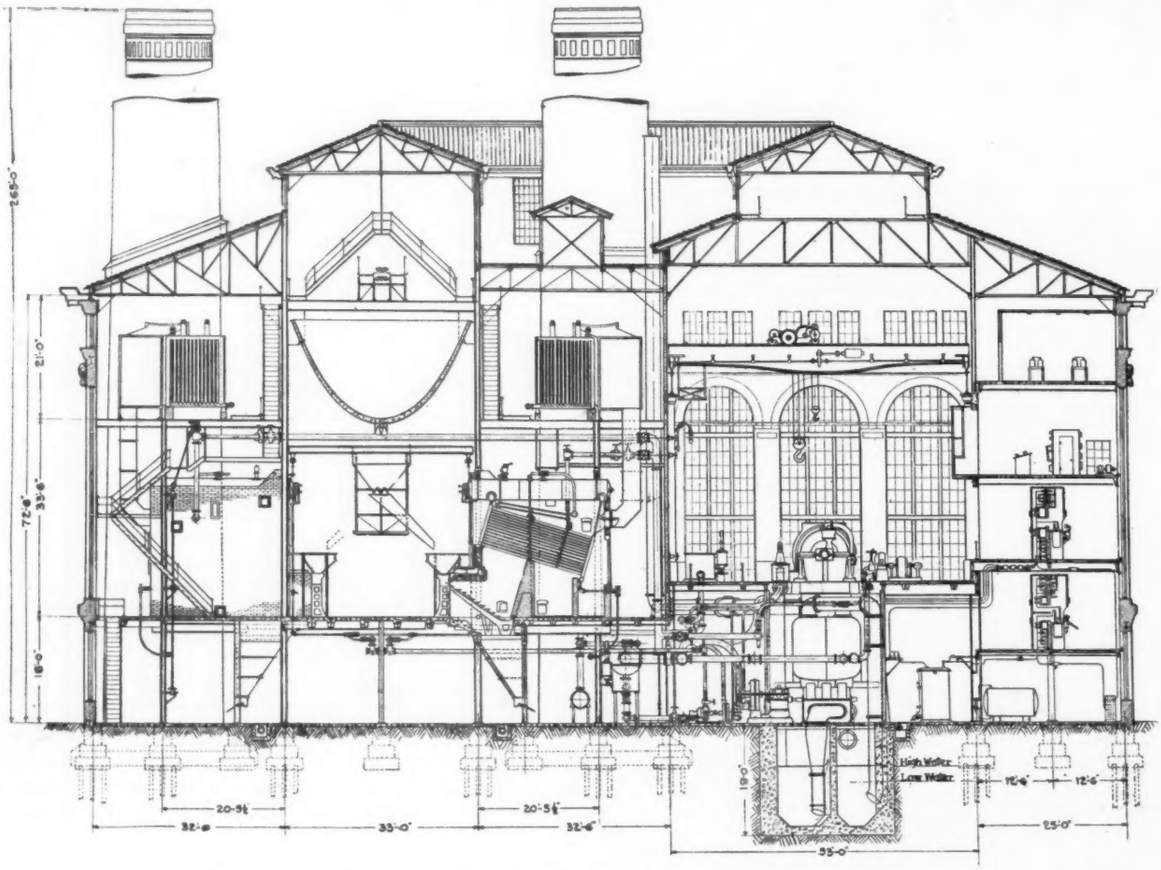


FIG. 1—CROSS-SECTION SHOWING ARRANGEMENT OF BOILERS AND TURBINES

Three sets of single-phase raising transformers for 13,200 volts with a rating of 6000 kva per bank were purchased as an initial equipment. These are provided with divided secondary coils and sub-voltage taps so that one bank may be used to supply energy to the 6000-volt distribution as long as that continues in service. The main generators are provided with automatic oil circuit-breakers having positive time-element and reverse-power trips, designed especially for the protection of the lead busbars and station wires, because the large current in case of a short-circuit could do very serious damage.

A fourth generating unit of the same rating as the first three can be installed in the present building with only relatively slight expense for modifications in the piping system and additions of corresponding sections to the busbar and switch structure and the control switchboard. Further extensions with similar or larger generating units can be made at either end of the present building, and these can be completed ready for

use before removing the present end walls without interfering with regular operation in any way.

Steam Generating Equipment

The tract of land on which the generating plant is situated has 600 ft. of waterfront on an arm of the harbor of Havana, and a reinforced-concrete wharf designed for 30 ft. of water has been built across the whole frontage. A track is laid along the face of this wharf, and this connects with the yard system in the plant track and with the double-track freight line of the Havana Terminal Railway, which crosses the property in the public streets between the wharf and the power plant. The principal object of the wharf is the receipt of coal, and for this purpose a complete unloading and conveying apparatus has been installed. This can take coal from barges or ships and deliver it to the storage bunkers of the plant, which hold about 3000 tons, or to the railroad cars for transport either to the present coal-storage yards near by or to any other point reached by the connecting tracks. Coal can also be received in cars from the storage yard or elsewhere and delivered to the plant bunkers. This extra precaution was taken because all coal must be imported, and it may be necessary or convenient to receive and store larger quantities of coal than the plant bunkers can hold. The yard has a normal storage capacity of 6000 tons and, in emergency, double that amount.

The 6000-sq. ft. boilers are equipped with improved Roney stokers, which provide for the evaporation of at least 40,000 lb. of steam per hour per boiler with the best efficiency at rates between 23,000 lb. and 28,000 lb. of steam per hour. At the customary rating of boilers this is equivalent to a maximum of 200 per cent of nominal rating with best economy between 130 per cent and 150 per cent. As each main unit with its auxiliaries requires about 180,000 lb. of steam per hour at the most economical load and 225,000 lb. at the maximum continuance load, eight boilers are allotted to each main group, this being enough to support the maximum load at best economy and still supply full-load safely with two boiler units out of service for cleaning or repairs.

The boilers are of the Babcock & Wilcox standard all-wrought-steel type set in brick with the front headers 12 ft. above the floor.

The stokers have flat suspended tile arches 6 ft. long projecting out in front of the boiler setting in a half Dutch oven. In consequence the stokers do not extend inside the combustion chamber or obstruct the gas passages.

Because of the high transportation cost it has been found most economical to use only the best grade of coal produced in the eastern part of the United States. At present New River semi-bituminous coal averaging about 14,800 thermal units per pound is being purchased.

All of the boilers are placed upon one level and are arranged in two lines of twelve units, each extending parallel to the long dimensions of the turbine room. They are set in batteries and face each other across a wide aisle. This arrangement was selected as offering the maximum free space and coolness with a minimum of ground occupied, the consideration of climate involving the need for ample ventilation. The length of the building was determined by that of the two rows of twelve boilers with two chimneys for each row. This length corresponds with that required for the generating and electrical equipment, leaving room for a fourth main unit to be added when the load reaches the permissible output of the original installation.

The four chimneys are 268 ft. high above the basement floor and 250 ft. above the grate. They are built of reinforced concrete with walls 19 in. thick at the bottom and 6 in. at the top, and they taper from 20.5 ft. in external diameter at the bottom to 15 ft. at the top. A separate self-sustaining concrete lining extends to a height of 104 ft. above the ground. The smoke flues are built of sheet steel stiffened with angles. They are 7 ft. wide by 12 ft. high and are placed over the aisles behind the boilers. Space has been left over each row of boilers for the installation of economizers in the future.

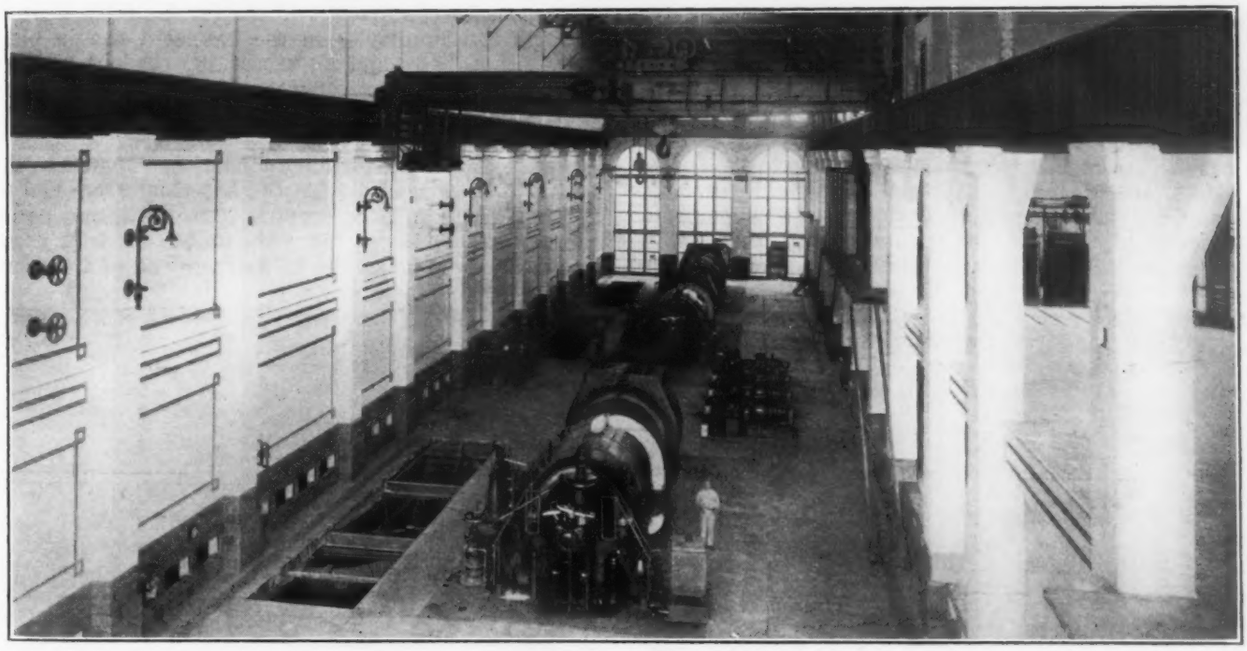


FIG. 2—INTERIOR OF TURBINE ROOM, SHOWING MAIN UNITS AND EXCITERS

Above the level of the boiler and over the wide aisle between them is a parabolic reinforced-concrete bunker to hold 3000 tons. Beneath this is a traveling larry with a 10-ton weighing hopper which can receive coal from gates placed at intervals of 10 ft. along the bot-

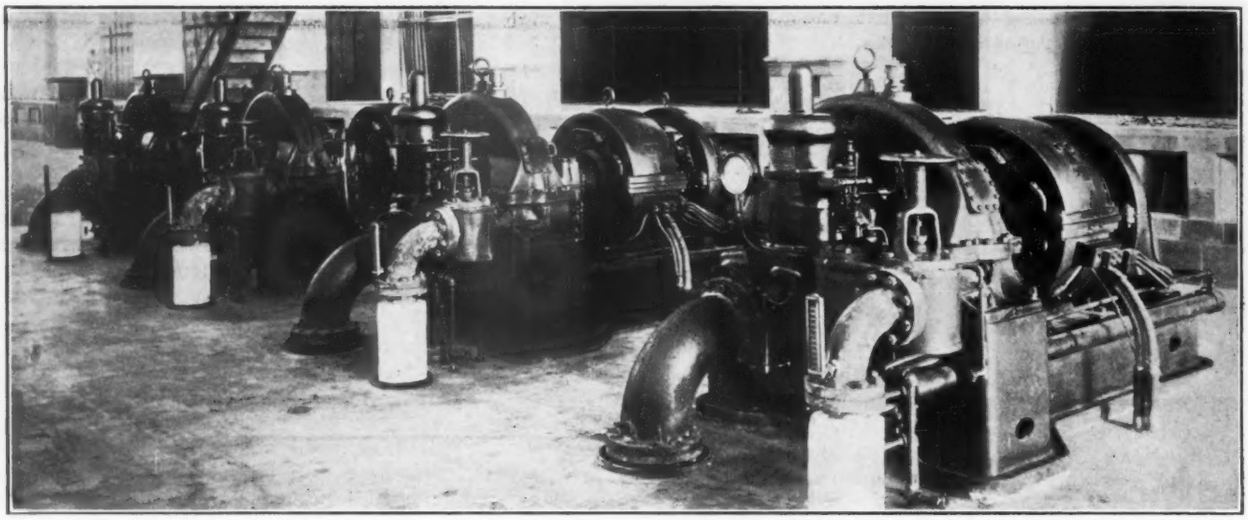


FIG. 3—BATTERY OF STEAM-TURBINE-DRIVEN EXCITERS

tom of the bunker. After the coal is weighed on the larry it is discharged into 4-ton steel receiving hoppers, which are set just over the usual feeding hoppers of the stokers. By this scheme coal can be drawn from any desired portion of the bunker, thus preventing bunker fires from becoming serious.

General Arrangement of Equipment

As the turbine room is placed alongside the boiler room with the turbines in a line parallel to the two rows of boilers, the three turbine units are so placed that each is approximately opposite to a corresponding group of eight boilers, four on each side of the center aisle in the boiler room. At the same time room is left at one end for an additional generating unit as well as a clear area about 40 ft. wide in the center of the turbine room, along one side of which are placed the four 100-kw exciter units.

A brick wall extending from the boiler-room floor to the roof divides the boiler house from the turbine room, but the basement is open and continuous to the further side of the turbine foundations. The main generating units are set on longitudinal steel beams supported on concrete piers transverse with this wall, thus leaving spaces under the unit and between the piers open for auxiliary apparatus and ventilation. In order to avoid having pumps below ground level, the main units and the turbine-room floor were set 24 ft. above the ground, thus affording ample head room from the condensers and auxiliaries. Directly below each main turbine is placed a 30,000-sq. ft. surface condenser with the circulating pump at the boiler-room end and the air and hot-well pumps at the side, all set on the ground floor. The other turbine auxiliaries are set along the wide aisle running the length of the basement on the side that is nearest to the boilers, the boiler-feed, service and heater pumps being in the central space between the second and third turbine foundations under the exciters on the floor above.

Large openings are left in the turbine-room floor so that all the auxiliaries in the basement are in plain view from above, and all except the condenser circulating pumps and the feed-water heaters can be reached directly by a 50-ton crane, which runs the length of the turbine room.

At the side of the turbine foundations opposite to the boilers a brick wall divides the basement from end to end but leaves full-size openings into the spaces under the generator ends of the main units. Each of these spaces is closed off at the boiler-room end of the piers

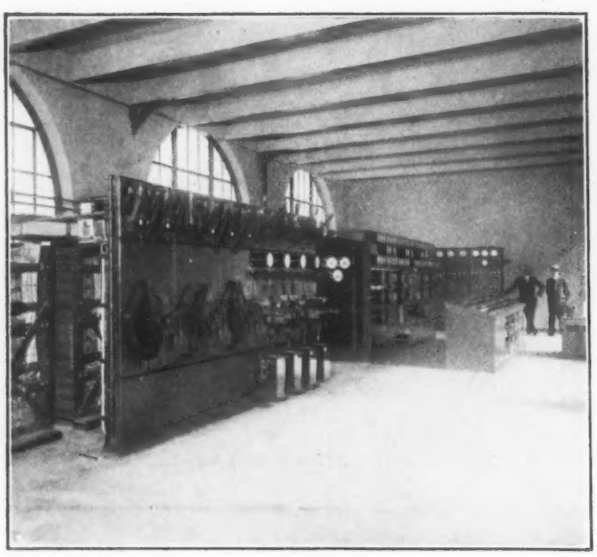


FIG. 4—OPERATING SWITCHBOARDS AND BENCHBOARD IN GALLERY

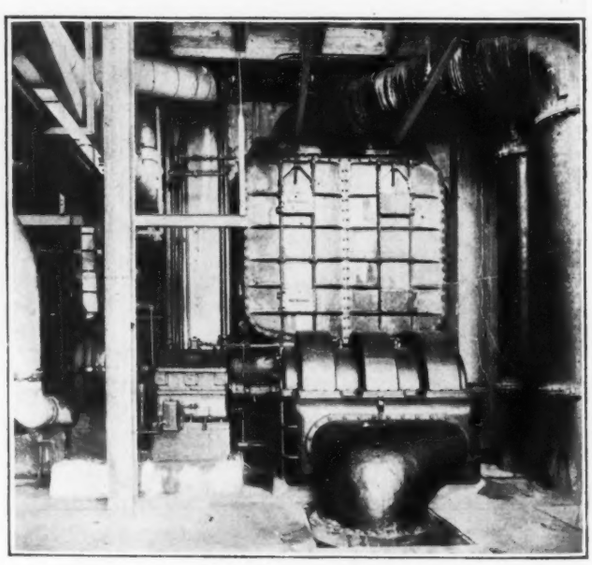


FIG. 5—SURFACE CONDENSER SEPARATED IN HALVES TO FACILITATE CLEANING

ELECTRICAL EQUIPMENT OF CONSOLIDATED POWER PLANT OF HAVANA ELECTRIC RAILWAY, LIGHT & POWER COMPANY

No.	Equipment	Type	Size	Use	Operating Conditions	Manufacturer
3	Turbo-generators	Horizontal	12,500 kva	Main units	1800 r.p.m., 2350 volts, three-phase, 60 cycles	W. E. & M. Co.
4	Do.	Do.	100 kw	Exciters	2400 r.p.m., 125 volts, d. c.	Do.
9	Transformers	O. I. W. C.	2,000 kva	Main transformation	2200/13,200 volts, single-phase, 60 cycles delta to Y	Do.
3	Do.	O. I. S. C.	200 kva	Station power	2200/220 volts, single-phase, 60 cycles, delta to delta	Do.
2	Do.	Do.	50 kva	Station light	2200/220-110 volts, single-phase, 60 cycles	Do.
3	Do.	Do.	5 kva	With S.K.W. motor-generator sets	2200/110 volts, single-phase, 60 cycles	Do.
2	Motor-generator sets	Horizontal two-bearing	5 kw	Storage-battery charging and control	110 volts, three-phase, 60 cycles, motor 125 volts, d. c. generator	Do.
1	Storage battery	E7 load and glass jars	60 amp-hr.	Inst. and circ.-breaker control	110 volts, d. c.	E. S. B. Co.
1	Transformer	O. I. S. C.	150 kva	High-tension testing	2200/2200 volts	W. E. & M. Co.
1	Do.	Do.	150 kva	Do.	2200/40,000 volts	Do.
1	Regulator	Induction	5 per cent buck or boost	Do.	For above 150 kva transf'mer	Do.
6	Oil circuit-breakers	Three-pole E4 cell type	4000 amp, 2500 volts	For main generator	2350 volts, 3200 amp, 60 cycles. Automatic with overload and reverse current relays	Do.
6	Do.	Three-pole E2 cell type	2000 amp, 2500 volts	For main transformer	Automatic with overload inverse-time-limit relays, 2350 volts, 1575 amp, 60 cycles. Full load	Do.
15	Do.	Do.	600 amp, 2500 volts	For main 2200-volt feeders	2350 volts, 600 amp	Do.
6	Do.	Do.	600 amp, 2500 volts	For high-tension side of transformer	265 amp, 1320 volts, full-load automatic with overload I. T. L. relays	Do.
12	Do.	Do.	300 amp	For 13,200-volt feeders	300 amp, 13,200 volts, full load	Do.
6	Feeder cables	Three conductor 7/64-in. lead and 3/32-in. by 3/32-in. paper, 2500 volts	Each conductor No. 1000 stranded. Each approximately 160 in. long	For feeding 2300-volt light and power distribution system	Suitable for a normal continuous capacity of 750 kw, three-phase, at 2300 volts	J. A. Roebling's Sons Co
5	Do.	Do.	Do. Approximately 280 in. long	For feeding substation No. 1 at 2300 volts, three-phase	Do.	Do.
2	Do.	Do.	Do. Approximately 30 in. long	For feeding station light and power	Do.	Do.
3	Do.	Three-conductor, 7/64-in. lead, 6/32-in. by 6/32-in. paper and steel arm., 15,000 volts	Each conductor 75 sq. mm (approx. 148,000 circ. mil), approx. 5000 ft. long	For feeding 6600-volt light and power distribution system	Suitable for a normal continuous capacity of 2000 kw, three-phase, at 6600 volts	Standard Underground Cable Co.
* 1	Do. Made up of two lengths of cable of different characteristics	Three-conductor, 7/64-in. lead, and 6/32-in. by 6/32-in. paper, 15,000 volts	Each conductor No. 1 stranded, approx. 2500 ft. long.	For feeding substation No. 2 at 13,200 volts, three-phase	Suitable for a normal continuous capacity of 1500 kw, three-phase, at 13,200 volts	J. A. Roebling's Sons Co.
		Three-conductor, 7/64-in. lead and 6/32-in. by 6/32-in. varn. cambric, 15,000 volts	Each conductor No. 4 stranded, approx. 4000 ft. long			Standard Underground Cable Co.
1	Do.	Three-conductor, 7/64-in. lead and 6/32-in. by 6/32-in. paper, 15,000 volts	Each conductor No. 1 stranded, approx. 2500 ft. long	For feeding substation No. 3 at 13,200 volts, three-phase	Do.	J. A. Roebling's Sons Co.
		Three-conductor, 7/64-in. lead and 6/32-in. by 6/32-in. varn. cambric, 15,000 volts	Each conductor No. 4 stranded, approx. 7000 ft. long			Standard Underground Cable Co.
1	Feeder cables of two lengths.	Three-conductor, 7/64-in. lead, 6/32-in. by 6/32-in. paper and 6/32-in. by 6/32-in. varn. cambric, 15,000 volts	Each conductor No. 1 stranded, approx. 900 ft. long Each conductor No. 1 stranded, approx. 5500 ft. long	For feeding substation No. 2 at 13,200 volts, three-phase	Suitable for a normal continuous capacity of 2500 kw, three-phase, at 13,200 volts	J. A. Roebling's Sons Co.
1	Do.	Do.	Each conductor No. 1 stranded, approx. 900 ft. long	For feeding substation No. 3 at 13,200 volts, three-phase	Do.	Do.
			Each conductor No. 1 stranded, approx. 6500 ft. long			
1	Do.	Three-conductor, 7/64-in. lead and 6/32-in. by 6/32-in. varn. cambric, 15,000 volts	Each conductor No. 4 stranded, approx. 17,500 ft. long	For feeding substation No. 4 from substation No. 2 at 13,200 volts	Suitable for a normal continuous capacity of 1500 kw, three-phase, at 13,200 volts	Standard Underground Cable Co.
1	Three-phase line	Solid bare wire	No. 1 solid, approx. 22,500 ft. long	For feeding substation No. 5 from substation No. 3 at 13,200 volts	Suitable for a normal continuous capacity of 2000 kw, three-phase, at 13,200 volts	U. S. Steel Products Co.
1	Three-phase line of three lengths as given	Do.	No. 1 solid, approx. 14,600 ft. long	For feeding substation No. 5 from substation No. 4 at 13,200 volts	Suitable for a normal continuous capacity of 1500 kw, three-phase, at 13,200 volts	Do.
		Three-conductor, steel armor, 7/64-in. lead, 6/32-in. by 6/32-in. varnished cambric	No. 4 stranded, approx. 900 ft. long			Standard Underground Cable Co.
		Three-conductor, 7/64-in. lead, 6/32-in. by 6/32-in. varnished cambric	No. 4 stranded, approx. 900 ft. long			Do.

FIG. 6—SUCTION TANK FOR ASH-HANDLING SYSTEM

so that one side of the basement serves as a ventilating duct or aisle and is completely separated from any part of the building containing steam machinery or piping. In this space the raising transformers are set and the main generator and exciter leads are run in the open between their respective generators and the bus and switch structures. Over the large transformers are removable hatches in the turbine-room floor, through which the crane can lift the transformers complete.

The entire side of the building opposite the boiler room is divided by four galleries about 26 ft. wide in which are placed all the station busbars, switch gear and electrical-control apparatus. This arrangement separates the electrical switching and control apparatus and the steam equipment almost as completely as if they were in separate buildings. At the same time it preserves the unity of the plant and the accessibility of each part of the equipment.

The first electrical gallery is open to the ventilating aisle but is shut off from the turbine room, while those above are separated from the turbine room only by the building columns and railings, except the operating room which is fully inclosed.

Circulating-Water Supply

Extending for the length of the building directly under the turbine foundations is a double canal for condenser circulating water which is drawn from and returned to the harbor. The top of the canal is covered with a 9-in. reinforced-concrete slab, upon which the circulating pumps are set, directly over the center wall which divides the entering water from the discharge. The turbine foundation piers are carried on the walls of the canal, across which they extend over steel girders.

Outside of the building the canal divides into two lines of cylindrical reinforced-concrete pipes. One of these connects the discharge canal to the harbor at the down-stream end of the wall, and the other runs parallel to the end of the building to a screen basin built for one of the old plants of the company at this point. The screen basin is connected to the harbor by a tunnel 5 ft. square. In this basin are four baskets made of copper frames covered with heavy wire screen. These are arranged so that flat screens may be dropped in front of them and the baskets be then removed one at a time, carrying the material they had strained out of the water. Any matter that lodges against the flat screens is washed into the basket when it is replaced and the flat screen removed. The screens are now lifted with a chain block which will later be replaced by compressed air hoists. The material removed consists largely of jellyfish, which clog the screens of the condenser tube if admitted, but when exposed on land soon vanish in an odor which is anything but sanctified.

Over the water level in the discharge canal and just below the cover is placed a 30-in. cast-iron water line which connects the inlet chambers of the three condensers so that, if necessary, any circulating pump can supply a limited amount of cooling water to any other condenser.

The water boxes, covers and circulating piping of each condenser are so divided that the circulating water can be cut off from one half, leaving the other half of the condenser in service. By means of this arrangement half of the tubes may be cleaned at a time with a loss of only 1 in. or 2 in. of vacuum during the process. This rather unusual arrangement was made because at times the harbor water adds in suspension a great amount of very sticky matter which coats the condenser tubes and reduces their heat-transmitting capacity very seriously. It is, however, easily washed out with a brush and a small stream of water. The condensers slope about 8 in. from the horizontal so that the tubes may drain empty when not in use. This diminishes the corrosion which is unusually severe because of the high temperature and impurity of the salt water used for cooling.

Steam-Driven Auxiliaries

To supply steam to the various engine-driven auxiliaries there are two loop headers, one for the exciters and one for the pumps. Both headers are connected into the 10-in. equalizer main on both sides of the middle boiler header and both are provided with valves so that exciters, boiler-feed pumps and house-service pumps

FIG. 7—CENTRAL AISLE IN BOILER ROOM

can be fed with steam from whichever section of the boiler plant is in service, leaving the remaining boiler group headers and the other two sections of the equalizer header entirely cold. The auxiliaries of each generating unit, comprising the condenser pumps, oil pump and gland pump, are connected directly to the equalizer or the line just opposite the main turbine.

With this turbine arrangement it is possible to operate any main generating unit, with a full complement of auxiliaries, from any of the boilers, although of course there would be considerable drop in pressure under extreme conditions. Full loads can be carried on one turbine when equipped with the maximum length of steam piping, and a large saving in cost of piping is effected by the use of a small tie line instead of a connected header system.

The exhaust steam from all the turbine-driven auxiliaries passes into a header running the length of the turbine and installed about 11 ft. above the floor. At the center connections are made with two open 300,000-lb.-per-hr. boiler-feed-water heaters. At suitable points connections are made to inlet valves on the low-pressure stage of each of the main turbines to admit steam to the turbines at constant pressure, so that when more

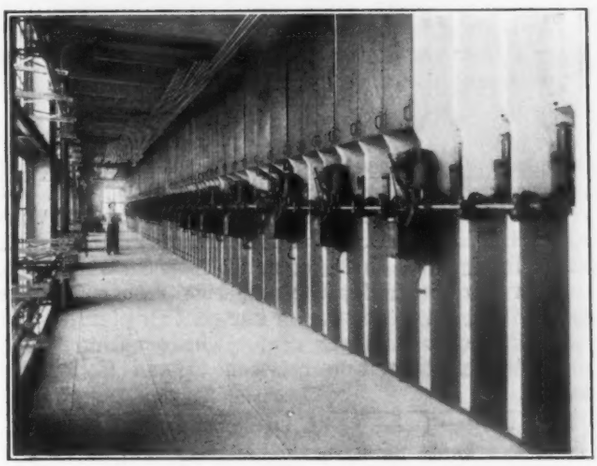


FIG. 8—OIL SWITCHES IN GALLERY

steam flows into the exhaust header than can be condensed in the feed-water heater these valves admit the surplus steam into the main turbines, where it does useful work. It is estimated that under normal conditions 1 lb. of this exhaust steam saves from 0.3 lb. to 0.4 lb. of high-pressure boiler steam, and then, as it is condensed, it becomes available for boiler feed instead of being wasted to the open air, as is usual. The exhaust header is, of course, provided with outlets to atmosphere through automatic back-pressure valves which are set to open at a slightly higher pressure than is needed to lift the constant-pressure valves into the low-pressure stages of the main turbine.

In order to allow the escape of air and other gases which are always present in steam the feed-water heaters are provided with vent pipes to a small surface condenser, through which the cold water passes on its way to the main heaters. Each heater, then, discharges through the vent a mixture of air and steam, the steam being condensed and the air escaping through a suitable opening. Owing to the arrangement of outlet valves of the exhaust system the heaters are always under a slight pressure, and therefore no pumps are needed to draw the mixture of air and steam to the vent.

The operating room for the plant is in the middle of the third gallery just opposite the exciters in the space between the second and third generators. The front of the room projects about 4 ft. beyond the gallery and is inclosed with wire glass set in steel casement sash. The lower panes are clear, giving a full view of the turbine room. One end of the operating room is closed by a concrete wall. Beyond this are the station-auxiliary transformers, but the other end is covered by a wood and glass partition which is movable to provide more space when it is required. From the projecting front of the room two flights of stairs run to the turbine-room floor. These are set close against the gallery and one leads toward each end of the building.

The control and instrument switches and indicator lamps are mounted on an inclined desk which is divided into sections, one for each generator, exciter, transformer bank and group of six feeders. These are arranged in the same order as the apparatus. On the desk is mounted a copper strip diagram of the station buses and connections. In this the control handles, signal lamps and model disconnector switches are placed to correspond with the real circuit-breakers and switches so that the operator has a plan of the station connections always before him with indications of the actual condition of all switches. The circuit-breaker controllers, ammeter switches and synchronizing switches are of the rotary drum type. The latter have detachable non-interchangeable handles of different colors to show the generator in operation and the incoming generator, together with interlocking circuit contacts which make it impossible to close the incoming generating circuit-breaker unless the right switch and handle are used in synchronizing. Each generator desk panel has also control switches for the corresponding field switch, motor-operated field rheostat and governor-adjusting motor of the steam turbines.

The indicating and recording instruments are mounted on a vertical board 3 ft. 6 in. behind the desk, the panels of the board being placed opposite the corresponding panels in the desk. The Tirrill voltage regulators are on the same vertical board.

Standing back to back with the instrument board and about 4 ft. behind it is a similar board containing the relays, circuit-breaker contactors and other small auxiliary devices. The exciters are controlled from a switchboard of seven panels standing in line with the instrument board. The exciter-control apparatus, consisting of knife switches for the positive, negative and equalizing leads, with a carbon circuit-breaker in each negative lead, is hand-operated, and the cables come direct from the exciter and generator field circuits to the switchboard. The exciter bus is in duplicate.

In connection with maintenance of the electrical equipment it should be remarked that an outfit for dielectric stress trials has been installed. This consists of a 150-kva, single-phase testing transformer, 2200 to 40,000 volts, with a separate regulating transformer which, when operated in conjunction with a small induction regulator, produces a smooth voltage curve from the zero to the maximum. This outfit is to be used to test the insulation of new apparatus, cables and repair work before putting it in service. All electrical apparatus is to be tried out from time to time to find the weak places without needless damage and so forestall and prevent breakdown when in actual service.

Ample locker and toilet rooms are provided for the different divisions of the operating force. These are situated in the basement of the boiler house, in the turbine room, and in each of the four electrical galleries. This portion of the equipment has seldom received adequate attention in Cuba, and it is intended to make this a model installation.

In conclusion, it should be said that all machinery and apparatus except the boilers and the turbines, the contract for which included erection, were received by

the railway company at the port of export and, after being landed in Havana by the steamship company, were taken to the plant and installed by a force employed directly by the Havana Electric Railway, Light & Power Company. The installation was subject in some cases to the advice and supervision of erecting engineers sent from a native plant, but all special foundations, structures for electric busbars and switches and the like were designed and carried out directly by the regular force in the employment of the electric company.

Officers and Engineers

A list of some of the officers and engineers of the company most closely related to the power development follows: President and general manager, Mr. Frank Steinhart; assistant general manager and chief engineer railway division, Mr. C. W. Ricker; chief engineer lighting division, Mr. D. Lombillo-Clark; superintendent of power, Mr. W. B. Flanders; electrical engineer, Mr. C. S. Sanderson; commercial engineer, Mr. E. W. Barron; engineer of power plant, Mr. R. L. Nelson.

Card System for Obtaining Life Records of Gas-Filled Lamps

Many purchasers of gas-filled tungsten lamps are employing original methods for determining the average life of their units so that they may confirm the terms of the guarantees. Some users have adopted the practice of selecting a definite percentage of all lamps in each lot, keeping data on these few lamps and considering this performance as being applicable to all. The Lincoln Park Commissioners of Chicago, on the other hand, have made arrangements to secure continuous and complete data on each individual lamp of their own large installation of these new units. In this way they expect to learn exactly the average life of each group of lamps purchased.

POST No. TYPE "C" RECORD

MAKE	SIZE	FILAMENT	LOCATION	INSTALLED	BURNT OUT	HOURS RUN

CARD FOR RECORDING LAMP-PERFORMANCE DATA

A card record is made out when a lamp is put into service. As first filled in the card gives only the make of the lamp, its rating, type of filament, location and the date installed. These cards are filed according to the post number on which the lamp is operated. When a lamp fails the trimmer replaces it with a new one and puts the old lamp in the box which held the new lamp, marking the post number, location and date on the outside of the box. Lamp and box are taken back to the chief operator of the system, and he transfers the data to the proper card. At the same time he consults a "progressive-total sheet" telling how many hours each circuit has been in operation since a certain date. By selecting data for the circuit from which this lamp was taken and subtracting the number of hours opposite the day indicated under "date installed" from the number of hours opposite the "date burnt out," the operator computes the hours' life of that particular lamp. Then the column "hours' run" can be filled in and a record for the new lamp on the same pole can be started on the card. In this way a complete record of the life of lamps in any location can be kept on a single card for a year or more.

Calculation of the Performance of an Induction Motor—II. Derivation of Formulas

BY WALDO V. LYON

Induction Motor.—In an induction motor the loss by friction and windage is supplied from the electric circuit. In order to simplify the computation it is assumed that the friction and windage is replaced by a core loss, so that the resulting core loss is equal to the actual core loss plus the friction and windage expressed in watts. It will be shown presently how the error that this substitution entails can be corrected.

At no load the vector diagram reduces to Fig. 2. In both Fig. 1 and Fig. 2 the component I_e of the no-load current is equal to the power input at no load less the copper loss in the stator divided by the emf generated by the air-gap flux, i. e.,

$$I_e = \frac{P_n - I_n^2 r_1}{E_2}.$$

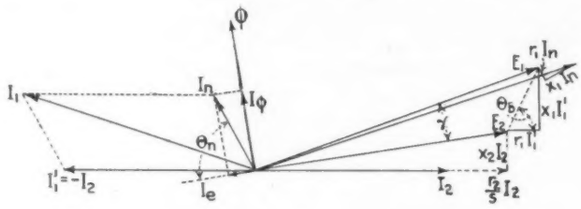


FIG. 1—CURRENT, FLUX AND VOLTAGE DIAGRAM

Observation of these two vector diagrams shows that the drop in the stator due to the no-load component of the current is nearly in phase with the impressed voltage, so that the *numerical* difference of V_1 and $z_1 I_n$ is practically equal to their vector difference. The greatest error made in taking the numerical rather than the vector difference is not over 1 per cent in practice and is usually below 0.25 per cent. The equation which shows the exact relation between V_1 and E_1 is (see Fig. 1):

$$V_1 = \sqrt{E_1^2 + (z_1 I_n)^2 + 2E_1(z_1 I_n)\cos(\theta_b - \theta_n - \gamma)}.$$

θ_b is the angle between the primary impedance and the primary resistance drop, and thus $\cos\theta_b$ is approximately equal to the power-factor with the rotor blocked. The limiting values of $\cos\theta_b$ are approximately 0.8 and 0.1, and it most frequently lies between about 0.4 and 0.15.

θ_n is the angle between the no-load current and its energy component with respect to the voltage generated by the air-gap flux. Since the angle between E_2 and V_1 is very small at no load, $\cos\theta_n$ is practically equal to the power-factor at no load. The limiting values of $\cos\theta_n$ are approximately 0.35 and 0.05, and it most frequently lies between 0.25 and 0.10.

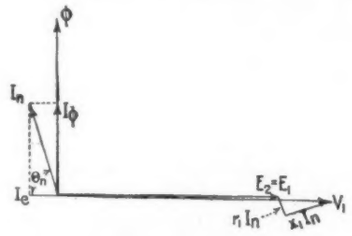


FIG. 2—NO-LOAD RELATIONS

γ is the angle between the vectors E_2 and E_1 and is approximately equal to one-half the angle between I_2 and E_1. The sine of this latter angle is closely equal to the percentage leakage reactance drop in both windings. The percentage of total leakage reactance volts at full

load varies from about 40 per cent to 10 per cent, and γ thus varies from about 12 deg. to 3 deg. It would most frequently lie in the neighborhood of 7 deg. at full load.

The drop in the stator winding due to the no-load component of the current, viz., $z_1 I_n$, will be taken as aE_1. The coefficient a is rarely as great as 10 per cent and is usually not more than 5 or 6 per cent. In practice a will be taken as the ratio of the impedance drop ($z_1 I_n$) to the impressed voltage V_1 rather than to the internal voltage E_1. The error thus introduced is negligible.

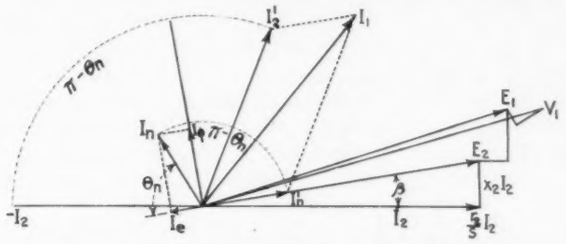


FIG. 3—RELATIONS UNDER LOAD CONDITIONS

The value of E_1 in terms of V_1 may be written in a more convenient form, thus

$$E_1 = \frac{V_1}{\sqrt{1 + a^2 + 2a\cos(\theta_b - \theta_n - \gamma)}} \qquad (19)$$

If a is not greater than 5 per cent and if the angle $(\theta_b - \theta_n - \gamma)$ is not over 16 deg., the error in assuming that the numerical and vector subtractions of V_1 and $z_1 I_n$ are equal is not greater than 0.2 per cent. In such a case it is sufficiently accurate to take the numerical difference, but if the motor is abnormal—i. e., if the values of a and of the angle $(\theta_b - \theta_n - \gamma)$ are greater than specified—it may be desirable to calculate E_1 by equation (19). Another approximation which reduces the computation slightly and which is still closer in the majority of cases is to assume that

$$E_1 = V_1 - x_1 I_n$$

This is the assumption used in the formulas given above.

The value of E_1 would be constant at all loads but for two reasons. The no-load component of the stator current is nearly proportional to the air-gap flux, and so to the voltage E_2 which this produces. Therefore, as the load increases the no-load current will decrease and E_1 will increase. Also, as the load increases the angle γ will increase. This may cause E_1 to increase or to decrease, depending upon whether the power-factor with the rotor blocked is greater or less than the power-factor at no load. Both of these effects are small and may usually be neglected with all propriety.

From Fig. 1 or Fig. 3 it follows that

$$I_2 = \frac{E_1}{\sqrt{\left(\frac{r_2}{s} + r_1\right)^2 + (x_1 + x_2)^2}}$$

When the total reactance drop at full load is less than about 25 per cent of the terminal voltage, this equation may be written, with an error of less than 0.1 per cent, as follows:

$$I_2 = \frac{E_1}{\left(\frac{r_2}{s} + r_1\right) + \frac{b}{\left(\frac{r_2}{2} + r_1\right)}},$$

where $b = \frac{(x_1 + x_2)^2}{2}$. This is equation (3) above.

When the reactance drop is as great as 40 per cent the error in this expression for I_2 is but 0.2 per cent.

The primary current is found simply by revolving I_n through an angle $(\pi - \theta_n)$ from its real position until it lies along E_2, and by treating $(-I_2)$ in a similar way so that it occupies the position I_2'. Noting that $\frac{r_2 I_2}{sE_2} = \cos\beta$ and $\frac{x_2 I_2}{E_2} = \sin\beta$, this gives

$$I_1 = I_2\sqrt{\left(\cos\theta_n + \frac{r_2 I_n}{sE_1}\right)^2 + \left(\sin\theta_n + \frac{x_2 I_n}{E_1}\right)^2}.$$

$I_n\left(\frac{E_2}{E_1}\right)$ is the no-load component of the stator current corrected for the change in the voltage generated by the air-gap flux. Putting c equal the constant ratio $\frac{I_n}{E_1}$ and d equal to the constant term

$$\left(\sin\theta_n + \frac{I_n}{E_1} x_2\right)^2,$$

this equation for I_1 becomes

$$I_1 = I_2\sqrt{\left(\frac{cr_2}{s} + \cos\theta_n\right)^2 + d},$$

which is equation (4) above.

The power output, torque, power input, power-factor and efficiency may then be expressed in terms of I_2 and I_1 in the usual manner.

Equations (1) and (2) for the relation between slip and output are derived as follows:

The vector diagram Fig. 3 reduces to Fig. 4 when X is put equal to $x_1 + x_2$ and R equal to $r_1 + r_2$. From this figure the output is

$$P_o = yI_2^2 = y\frac{E_1^2}{(y + R)^2 + X^2}$$

An approximate solution of this equation, in which the error is less than about 0.5 per cent, is

$$y = \left(\frac{E_1^2}{P_o} - 2R\right) - \frac{Z^2}{\left(\frac{E_1^2}{P_o} - 2R\right)},$$

where $Z = \sqrt{R^2 + X^2}$ and is the equivalent single-phase short-circuit impedance. This is equation (1) above.

The value of $\frac{r_2}{s}$ which is used in solving for the rotor current in equation (3) is

$$\frac{r_2}{s} = y + r_2.$$

This is equation (2) above.

In the preceding deductions it was assumed that the friction and windage loss was replaced by an equal core loss. For a given value of the stator current the rotor current would be a little larger than calculated if the friction and windage loss is transferred to the rotor, where it belongs. The true value of the rotor current is approximately equal to the value as calculated multiplied by $\left(1 + \frac{F + W}{P_o}\right)$. Since the rotor current is

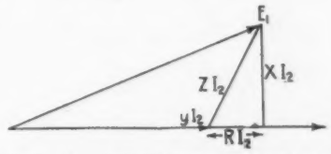


FIG. 4—SIMPLIFIED DIAGRAM

very nearly proportional to the slip, the true value of the slip should be taken as the assumed value multiplied by $\left(1 + \frac{F + W}{P_o}\right)$. For a given stator current the output would, of course, be unchanged, but the copper loss in the rotor would be slightly greater because of the

increase in the rotor current. The corrected copper loss would be $\left(1+2\frac{F+W}{P_o}\right)I_2^2r_2$, where I_2 is the value of the rotor current as calculated by equation (3).

The core loss also varies with the load, but it is difficult to say in what way. It is probably less as the load is increased and is sometimes, for example, assumed to vary as the square of the air-gap flux. The air-gap flux is proportional to E_2, which is very nearly equal to $\frac{r_2}{s}I_2$. Thus a corrected value of the core loss might be taken as $\left[\frac{\left(\frac{r_2}{s}I_2\right)^2}{E_1^2}\right]P_c$, where P_c is the core loss at no load.

Since the correction for the effect of the friction and windage increases the rotor copper loss and the correction for the effect of the air-gap flux decreases the core loss, these two tend to offset one another, and except in unusual cases it is doubtful whether they should be considered at all. The attempted accuracy is quite likely beyond the scope of this method of calculation. It is, however, well enough to correct the slip for the effect of the friction and windage when this loss is known.

Induction Generator.—The above method of calculation applies even better in the case of an induction generator. The vector diagram is given in Fig. 5.

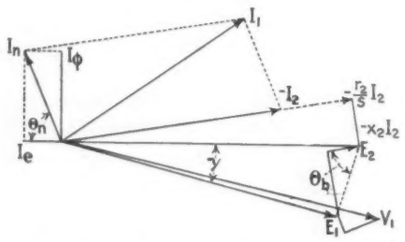


FIG. 5—RELATIONS UNDER NEGATIVE LOAD

The exact relation between V_1 and E_1 is

$$V_1 = E_1\sqrt{1+a^2+2a\cos(\theta_b-\theta_n+\gamma)}.$$

Because of the reversal of the sign before the angle γ, assumption that E_1 equals $V_1 - x_1I_n$ is generally better than in the case of the induction motor. Equations (13) to (18) for the induction generator are similar to those which apply to the induction motor except that the sign of s is changed. If, as in the case of the motor, it is desirable to make computations for some particular output, the relation between the output and slip can also be found in a similar way. From the vector diagram, Fig. 5, it is seen that the rotor current and the no-load component of the stator current are nearly in quadrature. Thus $r_1I_1^2$ equals $r_1I_2^2 + r_1I_n^2$ quite closely. Making this substitution in equation (16) gives

$$P_o = I_2^2\left(\frac{r_2}{s}-r_1\right)-P_n$$

where P_n is the input at no load when running as a motor.

Substituting for I_2^2 its value in terms of E_1 and the circuit constants gives

$$P_o = \frac{E_1^2\left(\frac{r_2}{s}-r_1\right)}{\left(\frac{r_2}{s}-r_1\right)^2+X^2}-P_n.$$

Putting $\left(\frac{r_2}{s}-r_1\right)=u$, and $P_o+P_n=P$, this gives

$$u^2-\frac{E_1^2}{P}u+X^2=0.$$

An approximate solution of this equation, in which the error is small, is

$$u=\frac{E_1^2}{P}-\frac{Z^2}{\frac{E_1^2}{P}}$$

where $Z=\sqrt{R^2+X^2}$. This is equation (11) above.

The slip is then

$$s=\frac{r_2}{u+r_1},$$

which is equation (12) above.

If the friction and windage loss is known it can be corrected for in a manner similar to that used in the case of the motor, except that now the corrected slip is equal to that used in the computation of the rotor current multiplied by $\left(1-\frac{F+W}{P_o}\right)$. The corrected rotor copper loss is the loss as calculated multiplied by $\left(1-2\frac{F+W}{P_o}\right)$. Owing to the phase relations of the vectors, it will be seen that E_1 and E_2 are nearly equal, and so the core loss will vary less than it does in the case of the induction motor. It may be assumed to remain constant without much error.

INDUSTRIAL IMPROVEMENT REFLECTED

Central-Station Gains in Output of Electrical Energy for January and February Keep Pace with Gradual Revival of Business

For the first month since October, 1914, the percentage gain in the output of electrical energy by central stations was greater in February than the percentage gain in income, according to statistical returns received by the ELECTRICAL WORLD covering 63 per cent of the industry. This is the condition that usually prevails during periods of normal business activity. The same condition—that is to say, greater rate of gain in output of electrical energy than in financial income—was reported in May, June and July, 1914, when operations were proceeding normally.

During the first three months of the European war the percentage gains in output of electrical energy were approximately the same as the percentage gains in income. Although November, 1914, showed an increase in output of electrical energy over November, 1913, the percentage of gain was not so great as that in income. This relation continued in December, 1914, and January, 1915. In February the percentage increase in output was again greater than that in income. The difference in the rates of gain is slight. It is about the same as the difference between the percentage rates of change

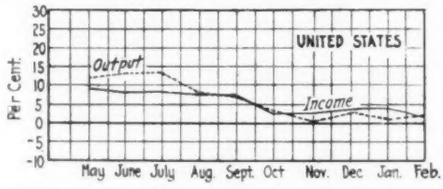


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT FOR UNITED STATES

in income and output during the first three months of the war.

The gradual industrial improvement which made its start with the beginning of 1915 is thus reflected in the results of central-station operation. Renewed activity in mining districts led to increases in the output of companies in the West. The effect of the increased

motor load was apparent. New and increased installations, some of which were not in full use during the last few months of 1914, are taking a share of the central-station energy.

The statistics indicate an increasing market for low-priced energy sold in quantities or at times to make a desirable load. The demand for high-priced energy in small amounts, mostly for domestic consumption, was lessened. Table I indicates that the increases in sales of energy for domestic consumption over the corresponding periods of the previous year were the smallest since May, 1914. Severe weather conditions in February, 1914, served to increase the lighting and thus the load. Household economy a year later, however, helped to reduce the demand. These statements are qualified to some extent by the large number of maximum rate reductions which went into effect at the beginning of 1915, but this was overcome in part by the incidental increase in the number of customers.

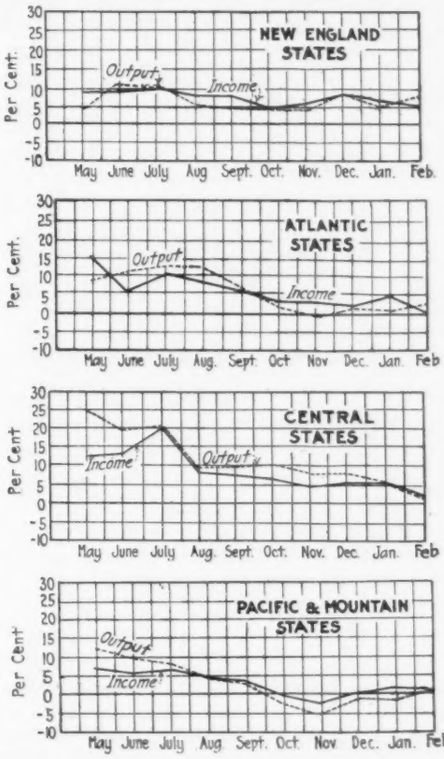
TABLE I—CENTRAL-STATION RETURNS FOR TEN-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw-hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
May	45	$14,295,321	$13,099,007	9.1	674,877,591	602,832,337	12.0
June	45	14,073,840	12,996,198	8.3	682,791,096	603,122,008	13.3
July	50	14,086,822	12,970,325	8.5	735,937,850	649,720,026	13.3
Aug	51	15,298,226	14,200,649	7.8	778,109,565	718,274,456	8.2
Sept	51	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
Oct	59	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.0
Nov	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
		1915	1914		1915	1914	
Jan	65	21,582,547	20,697,423	4.1	980,085,036	966,200,323	1.4
Feb	63	19,395,518	19,023,107	2.0	853,817,221	835,288,039	2.2

In the New England States, as will be seen from Table II, the increase in output again reached normal. The large cities reported decreasing numbers of unemployed, as well as successful efforts of new-business solicitors in the motor-service field.

The Atlantic States also reflect conditions in the country at large, but not so prominently as New England. In the large cities of the Atlantic group progress was retarded because the reaction in business was felt. Rate reductions also held back the growth in gross income. In the southern Atlantic States the cotton situation has been less clouded, and this improvement greatly benefited other industries.

Companies in the Central States still experienced a growth as compared with a year earlier, but this growth has decreased month by month. The larger cities were affected most. Better reports came from the northern part of this group of States than from the southern



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAIN BY MONTHS IN PER CENT SECTIONALLY

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TEN-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States (Illinois Excluded)			Percentage of Industry Represented	Pacific and Mountain States		
			1914	1913	Per Cent Increase		1914	1913	Per Cent Increase		1914	1913	Per Cent Increase		1914	1913	Per Cent Increase
INCOME	May	55	$1,745,160	$1,609,234	8.4	58	$6,492,767	$5,628,718	14.5	43	$3,200,553	$2,841,685	12.7	57	$1,525,729	$1,426,885	7.0
	June	58	1,560,872	1,442,178	8.3	54	6,067,780	5,578,311	6.0	52	3,914,836	3,459,497	13.2	67	1,894,887	1,791,918	5.8
	July	60	1,670,819	1,530,410	9.2	54	6,152,169	5,583,309	10.2	52	3,802,126	3,307,719	15.0	72	2,212,827	2,068,249	6.8
	August	61	1,734,583	1,607,649	7.5	55	6,224,896	5,755,515	8.2	57	4,389,696	4,051,678	8.4	75	2,386,677	2,282,061	4.6
	Sept	61	1,766,587	1,647,945	7.3	55	6,608,221	6,221,000	6.1	57	4,704,780	4,368,251	7.9	75	2,487,513	2,398,176	3.7
	Oct	64	1,963,579	1,889,255	4.0	67	7,451,220	7,232,063	3.1	57	5,105,810	4,783,847	6.8	85	3,146,160	3,157,689	0.3*
	Nov	67	2,229,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4.8	88	3,503,499	3,574,086	2.0*
	Dec	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,960,608	3,917,371	1.0
	Feb	67	2,246,794	2,134,341	5.4	69	8,037,878	7,968,625	0.9	55	5,296,786	5,148,439	3.0	85	3,576,432	3,534,864	1.2
KW-HR. OUTPUT	May	55	52,752,247	50,779,103	3.9	58	259,098,542	238,733,320	8.4	43	202,611,026	162,363,929	24.8	57	144,839,552	129,357,915	11.9
	June	58	53,463,013	48,049,756	11.1	54	244,936,886	221,315,464	10.8	52	217,920,183	182,406,207	19.4	67	155,326,455	141,836,377	9.6
	July	60	54,074,533	49,255,893	9.8	54	263,580,290	235,068,939	11.8	52	217,928,950	188,569,581	15.6	72	183,160,015	169,718,387	7.9
	Aug	61	55,801,224	52,913,483	5.4	55	264,717,319	237,984,895	11.2	57	267,501,400	226,276,638	9.4	75	193,216,699	185,330,705	4.2
	Sept	61	55,525,272	53,267,877	4.3	55	270,974,533	252,648,550	7.3	57	260,705,339	237,832,934	9.7	75	190,979,705	185,090,658	3.2
	Oct	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
			1915	1914			1915	1914			1915	1914			1915	1914	
	Jan	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	252,531,483	256,198,272	1.4*
	Feb	67	66,600,132	61,515,979	8.3	69	312,443,505	305,307,260	2.4	55	238,938,034	232,520,476	2.7	85	229,865,568	229,185,967	0.3

*Decrease.

part. Jitneys affect railway operations in the South, but this influence has been reduced by regulatory ordinances. The lead and zinc mine districts reported renewed activity. Increasing export trade along the Gulf of Mexico was noticeable. Many large industrial contracts have become effective.

In the Far West there has been a slight but gradual improvement. For the first month since September an increase in output is reported. A large amount of new motor-service business was gained, especially in the irrigation field.

The returns from May, 1914, to February, 1915, inclusive, as shown in Table I, show total gross income of $308,600,000 in comparison with $292,580,000 for the similar period of twelve months previous, or an increase of 5.5 per cent. The same rate of growth, 5.5 per cent, was shown in output, 15,227,000,000 kw-hr. in the later period, as compared with 14,334,000,000 kw-hr. in the earlier period.

The accompanying curves show graphically the percentage of growth given in Tables I and II. Tables I and II show the gross returns received by the ELECTRICAL WORLD. The remaining tables show the percentages of increase for companies grouped according to the size of the communities in which they operate. Group 1 includes cities whose population is over 100,000; group 2, cities between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5000 and 10,000.

TABLE III—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January	February
INCOME:						
Group 1	8.0	4.2	2.6	2.6	2.7	2.0
Group 2	8.2	4.7	4.7	4.9	8.8	3.7
Group 3	4.2	1.2	0.5	3.3	2.4	2.5
Group 4	10.0	15.1	4.8	4.8	5.8	6.8
Group 5	9.1	3.5	1.5	3.2	4.5	0.9
OUTPUT:						
Group 1	5.5	3.2	0.5	3.1	3.9	2.8
Group 2	14.0	5.2	4.2	3.0	4.3	5.7
Group 3	2.7	4.6*	7.2*	6.8	1.2	3.9*
Group 4	9.5	6.3	5.7	9.2	9.0	5.5
Group 5	4.0	2.9	2.6*	1.8	7.5	15.0

*Decrease.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January	February
INCOME:						
Group 1	5.8	5.0	6.1	7.9	7.1	5.7
Group 2	6.3	2.3	2.3	5.5	6.2	4.1
Group 3	7.0	6.1	9.7	11.4	7.5	0.7
Group 4	3.9	5.8	9.0	8.2	8.9	9.4
Group 5	17.8	8.0	3.9	5.5	2.1*	1.9
OUTPUT:						
Group 1	2.0	4.2	6.9	12.5	6.3	11.1
Group 2	12.0	1.0	1.5*	5.9	5.4	6.4
Group 3	7.4*	6.6	7.5	11.0	1.2	3.6*
Group 4	15.0	14.2	4.2	12.5	10.9*	9.4
Group 5	9.7*	8.1*	8.3*	4.1	9.0*	6.1

*Decrease.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January	February
INCOME:						
Group 1	7.8	6.2	3.0	1.6	1.3	1.3
Group 2	6.1	7.1	2.7	3.9	5.0	4.2
Group 3	7.9	1.4	0.3*	0.4	3.3	3.6
Group 4	8.3	6.8	4.8	7.9	4.9	10.1
Group 5	10.0	10.2	13.5	11.2	9.0	†
OUTPUT:						
Group 1	7.1	4.6	0.0	3.2	1.7	3.0
Group 2	15.6	10.3	5.0	4.3	3.1	7.0
Group 3	16.4	6.0*	8.5*	7.7*	7.4	3.6
Group 4	2.2	0.0	3.8	6.2	7.8	6.3
Group 5	26.8	46.5	57.5	11.1	13.5	†

*Decrease.
†Results omitted owing to insufficient returns.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January	February
INCOME:						
Group 1	7.7	7.0	4.7	5.2	6.1	3.5
Group 2	9.5	4.7	5.2	7.5	4.3	1.4
Group 3	0.0	4.0	4.0	7.5	2.1	6.2
Group 4	11.3	8.1	4.3	6.4	3.6	6.0
Group 5	9.5	1.6	0.5*	1.5*	3.7	2.8
OUTPUT:						
Group 1	5.7	6.3	2.4	4.2	9.0	4.7
Group 2	21.0	11.2	14.8	12.4	4.8	1.2
Group 3	4.4	5.0	6.6	12.4	8.2	6.2
Group 4	14.7	7.8	8.3	13.3	8.4	10.0
Group 5	21.0	5.0	4.9	13.0	13.7	18.3

*Decrease.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January	February
INCOME:						
Group 1	7.5	0.3*	2.4*	0.6*	1.0*	0.4
Group 2	13.1	2.0	1.1	1.0	4.9	8.0
Group 3	3.8	1.7*	3.5*	1.0	0.6	2.6*
Group 4	17.7	2.9*	1.4	6.5	6.2	0.6
Group 5	4.4	0.1	3.1*	2.5*	1.8	2.0*
OUTPUT:						
Group 1	2.3	1.6*	2.1*	0.0	1.5	0.5*
Group 2	4.5*	13.0*	7.7*	13.0*	7.2*	13.5
Group 3	2.7	7.3*	14.1*	14.2*	13.5*	11.5*
Group 4	12.0	7.1	4.4	3.7	9.5	0.6*
Group 5	7.2*	1.1	2.9*	1.0	4.1	9.9

*Decrease.

Cost of Constructing a Short Transmission Line

With the extension of central-station service into rural territory the construction expense of moderate voltage transmission lines becomes of interest. The accompanying cost data are taken from the construction sheets of a Massachusetts central station which recently built an 11,000-volt single-phase transmission line across a portion of Cape Cod 8.1 miles long, pole location rights being secured from real-estate owners en route:

539 35-ft. poles, at $6	$3,234.00
1204 Victor insulators, at 20 cents	240.80
539 pairs braces, at 26 cents each	140.14
11,843 lb. bare copper wire, No. 4, at 16.75 cents	1,983.70
Carting poles	650.00
130 guys, at $1.14	148.20
424 lb. No. 6 bare wire, at 18 cents	76.32
1095 two-pin cross-arms, at 40 cents	438.00
2190 1½-in. by 12-in. locust pins, at 4 cents	87.60
2 transformer towers	348.00
5 11,000-volt lightning arresters, at $43.50	217.50
2 11,000-volt air-break switches, at $100	200.00
1 2300-volt oil switch	89.20
Right-of-way	345.00
Freight	183.00
Labor	4,800.00
Total	$13,181.46
Per mile of line	$1,620.00

The company obtained the permits for running the wires and also for the pole locations, the erection work being by contract. The contractor trimmed all poles, which averaged 125 ft. in spacing. Poles were head-guyed every half-mile, all guys being provided with porcelain insulators, and every twelfth pole was double-armed. Tree trimming was done by the contractor.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

American Standardization Rules.—An account of the discussion which followed the reading of the recent paper by L. Schueler before the Berlin Electrical Society on the new standardization rules of the American Institute of Electrical Engineers. Rüdenberg acknowledged the very great care which the American Institute has taken in working out the rules, but thought that it had gone somewhat too far since the strict rules, especially on temperature measurements, were not justified by the present knowledge of the rise of temperature at different points of a machine nor by the technique of commercial temperature measurements. He feared that strict adherence to the rules would lead the designer to unnecessary precautions and waste. L. Adler agreed with Rüdenberg that the American rules are too strict, but thought that the German rules, according to which the temperature of the armature is measured by thermometers, are not strict enough. They are liable to lead to insulation faults.—*Elek. Zeit.*, March 25, 1915.

British Standardization Rules.—The rules supplementary to the standardization rules for electrical machinery, issued by the British Electrical & Allied Manufacturers' Association, are here published. The supplementary rules deal with short-circuit tests, commutation, pressure regulation, parallel operation, efficiency and "tolerances." A tolerance is the amount of permissible difference between the observed results and the guaranteed results. The following tolerances are recommended: For observations of temperature rise, 2 deg. C. Efficiency (*a*) by steam consumption, 2.5 per cent on the guaranteed efficiency; (*b*) for the full-load efficiency of transformers (by summation of losses), for an efficiency of 98 per cent or higher tolerance, 0.25 per cent; for an efficiency below 98 per cent tolerance, 0.4 per cent. Tolerances for the efficiency of generators, motors and converters, and for the power-factor, the speed and the inherent pressure regulation rise, are also given. As to the terminal markings of three-phase transformers it is said that the different phase windings are to be distinguished by the letters A, B, C, indelibly marked on their respective terminals. The same letters are to be used on the high-pressure and low-pressure terminals of similar phases. The distinction between "high-pressure" and "low-pressure" terminals in any phase shall be made preferably by using small letters for the low-pressure markings and capitals for the high-pressure markings. It is, however, permissible to indicate the low-pressure winding by the use of capital letters with a circle around each letter. The relative polarity of the two ends of every winding will be shown by the addition of the markings O to I after the phase letters. The terminal marked I will be referred to as the positive end of the winding. The polarity of the corresponding high-pressure and low-pressure windings must be so marked that the progression of the emf at any moment from A_0 toward A_1 is in the same direction as from a_0 toward a_1 (and similarly for phases B and C). That is to say, if the negative terminal of the high-pressure winding is connected to the positive terminal of the low-pressure winding, the emf across the two remaining terminals will be more than that across the high-pressure winding alone. It is recommended that a diagram of internal connections showing the position of all leads and tappings shall be permanently attached to each transformer. In the rules on switch-gear symbols it is said that the arrangement of busbars should be such that the red and blue phases are outside, and the bars should be indicated in the order of the national colors—red, white (or yellow) and blue (R, Y, B). When arranged horizontally the red phase should be the top, or the bar farthest away as viewed by the operator from the main control position in any direction. When arranged vertically the red phase should be the left, or the bar farthest away as viewed by the operator from the main control position in any direction. The symbol letters for instruments are as follows: Ammeter, A; voltmeter, V; wattmeter (indicating), W; ampere-hour meter, AH; recording (graphic) wattmeter, GW; recording ammeter, GA; recording voltmeter, GV; watt-hour meter, WH; overload relay, OR; overload constant-time-limit relay, OTR; overload inverse-time-limit relay, OIR; reverse relay, RR; reverse power relay, RPR; reverse current relay, RCR; power-factor indicator, PFI; synchroscope, S; frequency indicator, F; earth plate, E; neutral (direct current), I.—London *Electrician*, April 23, 1915.

Slot Insulation Design.—H. M. HOBART.—The phases of slot-insulation design which are treated in this article are the voltage gradient through the insulation from an alternator armature conductor to the sides of the slot, the necessity for using an insulation capable of withstanding a high temperature, and the importance of obtaining complete information on the useful life of insulation. The major share of the article is devoted to a comparison between the unit dielectric stresses in the slot insulation of a low-voltage alternator and those in a high-voltage machine. A specific example is assumed, and an analysis which is made of several variations in the slot insulation design demonstrates the magnitude of the influence which insulation thickness and specific inductive capacity have on the design of slow insulation.—*Gen. Elec. Review*, May, 1915.

Turbo-Alternators.—O. BILLIEUX.—The first part of a highly mathematical article on critical speeds of turbo-alternator sets.—*La Lumière Elec.*, April 10, 1915.

Armature Reaction.—M. DE CONNICK.—A mathematical article illustrated by diagrams on the armature reaction in alternators with projecting poles.—*La Lumière Elec.*, March 6 and 13, 1915.

Lamps and Lighting

Cleaning-Up Reactions in Tungsten Lamps.—I. LANGMUIR.—An account of an extended investigation of the fact that a highly heated tungsten filament will cause the disappearance or "clean-up" of nearly any gas introduced into the bulb at low pressure, and that this action in the great majority of cases is purely chemical in nature. The author points out that the study of chemical reactions at very low pressures is the best means of getting a clear insight into the kinetics of the reaction. There are four classes of cleaning-up reactions in incandescent lamps. The filament is directly attached by the gas, or the gas reacts with the vapor given off by the filament, or the filament acts catalytically on the gas, producing a chemical change in the gas without any permanent change in the filament, or the gas is chemically changed or made to react with the filament by means of electric discharges through the gas.—*Met. and Chem. Eng'ing*, April, 1915.

Electric Safety Lamp.—JOHN GEORGE.—A paper read before the Scottish branch of the British National Association of Colliery Managers. The author points out the disadvantages and dangers of flame lamps and says that almost all terrible explosions, involving loss of life, have occurred in flame-safety-lamp pits. The relighting

problem is the greatest drawback to flame safety lamps. Electric safety lamps are a little more expensive in first cost, but their greater safety counterbalances this disadvantage. As to their cost of maintenance, Walter Hargreaves has estimated the cost at his colliery of maintaining 4275 electric safety lamps for a period of eighteen months, the total cost per lamp per shift being stated at 0.6282 cent. Lead cells are usually employed of the pasted type. The casing of the lamp is made of steel plate and strengthened generally by corrugations. The top part of the lamp is fitted to the bottom part by a bayonet joint, which allows sufficient movement for the lamp to be switched on and off, this being done by holding one part and turning the other slightly. One type of lamp is fitted with a fuse arrangement, so that in the event of the outer glass getting smashed this fuse immediately blows and thereby insures complete safety from sparks, etc., which would otherwise occur. This fuse arrangement is very simple and has no tendency to go wrong in every-day use. This same type of lamp is also fitted with springs, arranged to give the bulb a spring-cushion seat and thus protecting it from serious shock. The springs also act in conjunction with a fuse arrangement, thereby filling a double rôle. With special charging racks the method of charging is simple.—*Iron and Coal Trades Review* (London), March 19, 1915.

Fluctuation of the Light of Alternating-Current Lamps.—M. LEBLANC, JR.—A review of Irving Langmuir's work on the fluctuation of the light of metallic-filament incandescent lamps in an alternating-current network.—*La Lumière Elec.*, Jan. 30, 1915.

Integrating Sphere Photometer.—A. UTZINGER.—An account of an investigation made by the illuminating committee of the German Association of Electrical Engineers of a suitable paint for painting the interior of the Ulbricht integrating sphere photometer. A prescription is given of two paints to be used in succession. —*Elek. Zeit.*, March 25, 1915.

Generation, Transmission and Distribution

Electricity in Mines.—J. H. RIDER.—The conclusion of his paper read before the British Institution of Electrical Engineers on the energy supply of the Central Mining Rand group. The author discusses the use of electric compressors, motor control gear and electric distributions, and describes in some detail the troubles which they had had in practice with the electric installation. An account of the discussion which followed is given, and there is also an editorial on the subject. —London *Electrician*, April 23, 1915.

Powdered Coal as Fuel.—An illustrated description of the apparatus employed in the plant at Anaconda, where powdered coal is employed for firing the reverberatories. The design of a new burner due to N. L. Warford is described.—*Met. and Chem. Eng'ing*, May, 1915.

Traction

Three-Phase Traction.—MAURICE D'ASTE.—An article on improvements in the three-phase locomotives of the Italian state railways.—From *La Lumière Elec.*, Jan. 16, 1915, translated in abstract in London *Electrician*, April 16, 1915.

Installations, Systems and Appliances

Industrial Motor Applications.—H. B. BARNES.—An article giving some considerations which affect the choice of motor and auxiliary equipment in the metallurgical and chemical industries. The author deals in succession with the choice of the system, motor characteristics, character of service, variable speed, converting apparatus, and starting and protective apparatus.—*Met. and Chem. Eng'ing*, May, 1915.

French Electrical Industries.—E. DIEUBONNE.—A statistical article on the import and export trade of France in the electrical industry and on the present condition of the French electrical industry and the effects of the war.—*La Lumière Elec.*, March 30, 1915.

Oil Circuit-Breakers.—G. ROTH.—An illustrated article on high-tension oil circuit-breakers. The properties required in the oil and various principal points in the design of the circuit-breaker are discussed.—*Bull. de l'Ass. Suisse des Elec.*, No. 5, 1914; abstracted in *La Lumière Elec.*, Jan. 30, 1915.

Electricity on Ship Board.—H. L. HIBBARD.—An illustrated account of the various applications of electricity in naval warfare.—*Sibley Journal*, May, 1915.

Units, Measurements and Instruments

Self-Induction Coils.—R. E. SHAWCROSS AND R. I. WELLS.—Maxwell states that if the section of an induction coil is square the maximum self-inductance is obtained when the mean diameter of the coil is 3.7 times the side of the square section. The authors investigated the effect on the self-inductance of a departure from the maximum conditions, and the effect of a variation of the shape of the section. For a coil with a mean radius a and a rectangular section of width b and depth c, the results are given in the diagram Fig. 1. The

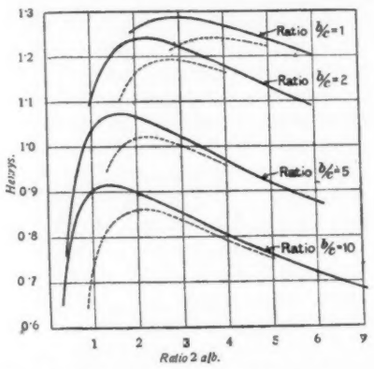


FIG. 1—SELF-INDUCTANCE OF WIRE COIL IN TERMS OF RATIO OF DIAMETER TO LENGTH

curves refer to a wire of 1 mm diameter and 1570.8 m long, coiled up in different forms. The full lines represent the self-inductance obtained by Rosa's correction method, the dotted lines are by Maxwell's approximate formula. The curves show clearly the disadvantage of making the diameter too small. The maximum point indicated by Maxwell was not quite correct but erred on the right side. With regard to the section of the coil the square is the most economical, and the greater the proportion of b to c the worse the result. Single layer coils, though having many other advantages, are, from the point of view of economy, the worst. The curve for this case is similar in shape to those shown and has a maximum at $2a/b = 2.5$, but it is not given as it would apply only to the particular length and diameter chosen.—London *Electrician*, April 16, 1915. In two communications by A. Russell and P. R. Coursey the authors think that the statement is erroneous that the inductance of a single layer coil of cylindrical shape is a maximum when the ratio of its diameter to its height is 2.5. The former author finds that the ratio should be 2.4525 and the latter that it should be 2.415. —London *Electrician*, April 23, 1915.

Induction Meters.—An official communication of the Reichsanstalt describing an induction meter for single-phase alternating current of the Isaria Company and admitting it for calibration.—*Elec. Zeit.*, March 18, 1915.

Telegraphy, Telephony and Signals

Pure Electron Discharge for Wireless Telegraphy and Telephony.—IRVING LANGMUIR.—The electron emission from heated metals at very low pressures has been investigated by scientists for many years, and the observations have been generally explained to be the result of chemical reactions with slight traces of gas. In the first half of this article, which is arranged in the form of a historical review, are related the experiments leading to the conclusion of the existence of pure electron emission in even the highest attainable vacua. After outlining the fundamental principles which govern this phenomenon the author shows how, through the medium of the kenotron (a hot-filament vacuum rectifier) and the pliotron (a new type of amplifier), both of which employ the pure electron emission from heated metals in extremely high vacua, a very simple and successful equipment has been produced to send and receive radiotelegraphic and radiotelephonic messages. The kenotron was described and illustrated in the ELECTRICAL WORLD, March 13, 1915, page 659. The pliotron is a kenotron in which a third electrode has been added for the purpose of controlling the current flowing between the anode and cathode. The three elements, hot-filament cathode, grid and anode, are similar to the elements of the De Forest audion, but the operation of the audion is in many ways quite different from that of the pure electron device. In the construction of pliotrons it has been found desirable to make the wires constituting the grid of as small cross-section as possible. In this way, even when a positive potential is applied to the grid, the current that flows to the grid may be made extremely small. The use of very fine wire is made possible by using a frame of glass, metal or other suitable material to support the grid. Thus, in Figs. 2 and 3, the filament is mounted in the center of a frame made of glass rods, on which the fine grid wire is wound by means of a lathe. The grid may thus consist of tungsten wires of a diameter as small as 0.01 mm, and these may be spaced as close as 100 turns per centimeter, or even more. In Figs. 2 and 3 are shown two types of pliotron. Fig. 2 shows a pliotron such as is used for amplifying radio signals in a receiving station. Fig. 3 shows a large pliotron which may be used for controlling as much as 1 kw of energy for radiotelephony. The characteristics of the pliotron depend upon the length of filament used, the distance between filament and grid, the spacing between the grid wires, the diameter of the grid wires, the distance between the grid and the anode, and the size and shape of the anode. The important elements in the characteristics of a pliotron are, first, the relation between the current flowing between the anode and the cathode as a function of the potential on the anode and of that on the grid; second, the current flowing to the grid as a function of the potential of the grid and the potential of the anode. Fig. 4 shows the characteristics of a small pliotron such as that shown in Fig. 2. Curve A shows the current flowing to the anode for different grid potentials, while the potential of the anode is maintained constant at 220 volts. Curve G shows the current flowing to the grid under the same conditions. For different anode potentials these curves are shifted vertically by amounts proportional to the change in anode potential. A similar characteristic is given for the larger type. By using a fine grid the current to the anode can be stopped entirely by even a very slight negative potential on the grid. On the other hand, a rather low positive potential will then be sufficient to draw a large current to the anode. The amount of current taken by the grid would be only a very small fraction of that flowing to the anode, in case the diameter of the grid wires is small compared to the distance between them. On the other hand, with a coarse grid—that is, a grid in which the spacing is large—a rather large negative potential may be necessary in order to stop the current flowing to the anode. It is evident from the characteristics of the pliotron that any number of these devices may be placed in parallel, and that in this way very large amounts of power may be controlled. The author then discusses the use of the pliotron as a detector, amplifier and oscillator in the receiving station, and finally deals with the use of the pliotron in wireless telephony.—*Gen. Elec. Review*, May, 1915.

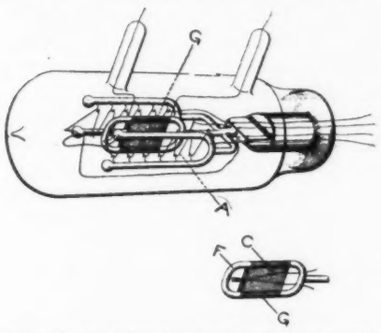


FIG. 2—PLIOTRON USED FOR AMPLIFYING RADIO SIGNALS

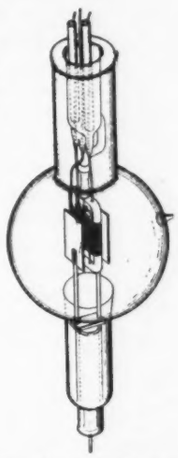


FIG. 3—LARGE TYPE OF PLIOTRON

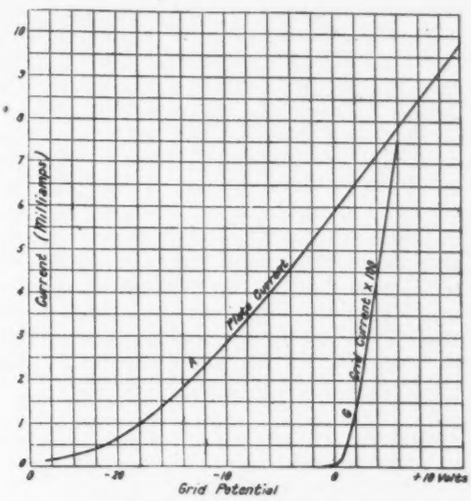


FIG. 4—CURVE SHOWING CHARACTERISTICS OF SMALL TYPE OF PLIOTRON

Transmission Speed in Wireless Telegraphy.—H. ABRAHAM, A. DUFOUR AND G. FERRIE.—A paper presented before the French Academy of Sciences on the speed of propagation of the waves used in wireless telegraphy over the surface of the earth. The method used is as follows: Station 1 emits a signal to which Station 2 replies by a second signal. In Station 1 the time T_1 is measured between the departure of the first signal and the arrival of the second, and in Station 2 the time T_2 is measured between the reception of the first and the emission of the second signal. The time $T_1 - T_2$ is the time of transmission of the first signal from 1 to 2 and of the return signal from 2 to 1. The time $T_1 - T_2$ are measured by means of photographic microgalvanometers. By this method it is possible to measure the interval of time with an absolute precision which may become 0.00001 second. The wireless-telegraph waves are propagated over the surface of the earth with a speed apparently slightly less than the speed of light.—*L'Industrie Elec.*, March 25, 1915.

Book Reviews

HEAT ENGINEERING. By Arthur M. Greene, Jr. New York: McGraw-Hill Book Company, Inc. 464 pages, 198 illus. Price, $4.

In the preface to this book the author makes it quite clear that he has no intention of producing an elementary treatise on thermodynamics, since he assumes that the reader is already well grounded in the principles of the subject. As a result, the book is advanced in character and is intended for use as a textbook for the instruction of students in technical schools. It covers the entire field of application of heat in engineering. The first chapter, which is a résumé of thermodynamic theory, is followed by a short one on heat engines and efficiencies. The third chapter is extremely comprehensive and deals with the transmission of heat in boilers, condensers, feed-water heaters, evaporators, radiators, and through walls and partitions. There is a fourth chapter on air compressors and the transmission of air. The next two chapters cover the steam engine in its simple and multiple-expansion forms. The heat problems involved in the action of steam nozzles, injectors and steam turbines are explained in the succeeding chapter, and the next one treats of condensers, cooling towers and evaporators. In the concluding chapters are taken up the subjects of internal-combustion engines and refrigeration. The text throughout is liberally interspersed with problems completely solved to show the application of the various formulas in engineering work, and at the end of each chapter are several unsolved problems, the object of which is to test the ability of the student to apply the principles and formulas in that chapter. All of these problems possess the admirable quality of practicality, inasmuch as they involve concrete examples of engineering calculations instead of abstract theory.

ADVANCED THEORY OF ELECTRICITY AND MAGNETISM. By William S. Franklin and Barry MacNutt. New York: The Macmillan Company. 300 pages, 217 illus. Price, $2.

From the point of view of the teacher who realizes the value of arousing the student's interest and of permitting him to form a physical conception of the thing discussed, the aim of the authors is commendable. "The character of the treatment in this book has been determined throughout by the desire to keep the student's mind jammed up tight against physical things." These words, which are printed in italics, occur in the preface and account to some extent for the appearance of yet another textbook treating of electricity and magnetism. Although the mind may be trained and the imagination stimulated by much that has not and cannot have any physical significance, it is probably true that the average student will benefit by having his mind "jammed tight against physical things." The desire to explain the fundamentals of theoretical physics by means of mental pictures based on our common knowledge of natural phenomena is not alone sufficient to insure success, and abstract mathematical conceptions are with difficulty avoided. Thus, however willing the reader may be to have his mind glued against physical things, he need go no farther than page 2 before he is invited to forget what he may chance to know about real magnets and devote all his attention to "ideally concentrated poles at the ends of ideally slim bar magnets." This conception relieves the authors of much arduous work because it enables them to treat the remainder of the chapter in the conventional manner. The unit magnetic pole is defined, and the work proceeds in the ordinary way. Considering the book as a whole, the effort to keep the physical conception always before the reader has been in a large degree successful. Mechanical analogies are freely used, and even such difficult subjects as electric oscillations and electric waves have been presented in a manner which should appeal to both teacher and student. Part I deals with magnetism and concludes with an interesting chapter on ship's magnetism and the compensation on the compass; Part II deals with electric charges, condensers, potential gradients and electric oscillations, while Part III, consisting of one chapter only, is devoted to the electron theory. By making use of mechanical analogies and avoiding the mathematical treatment this chapter appeals to those unable to read more advanced works.

THE ELECTRON THEORY OF MATTER. By O. W. Richardson. New York: G. P. Putnam's Sons. 612 pages, 58 illus. Price, $4.50.

A mathematical treatise on the modern electron theory. The work is scholarly and thorough. Heaviside units, as distinguished from B.A. units, are extensively used. The book is divided into twenty-two chapters relating respectively to the following topics: Origin of the electron theory, electric intensity, dielectric media, electron theory of dielectrics, magnetism, electromagnetism, electromagnetic waves, dispersion, fundamental equations, activity of the forces, charged system in uniform motion, charge moving with variable velocity, the ether, the principle of relativity, radiation and temperature, theory of magnetism, kinetic theory of electronic conduction, equilibrium theory, types of radiation, spectroscopic phenomena, structure of the atom, and gravitation. The treatment of the subjects is essentially mathematical and is likely to appeal only to advanced students of mathematical physics. The result of the textbook as a whole is virtually a demonstration of the existence of electrons and a classification of the physical consequences which ensue from their actions.

HANDBUCH DER ELEKTRIZITÄT UND DES MAGNETISMUS. In five volumes. Vol II. Edited by Dr. L. Graetz. 135 pages, 33 illus. Price, 5.4 marks for the five volumes.

This represents the second part of Volume II of a so-called "handbook"—a lengthy theoretical treatise on electricity and magnetism. The treatment is scholarly and thorough, and from the physical rather than the mathematical standpoint. Some of the phenomena discussed in this part are recondite and have but little literature. The treatise has, therefore, a distinctly useful field in presenting the knowledge thus far available in all the known directions concerning electromagnetics. The part is divided into three sections, relating respectively to electric convection, electric osmose and the electric generation of heat. Taking the first section on electric convection or the production of magnetic effects by the rotation of electric charges, there is perhaps no publication in which the phenomena thus far recorded are more fully collected and presented than in this volume. When completely issued the book will have considerable value as a work of reference for advanced students of electromagnetics.

Books Received

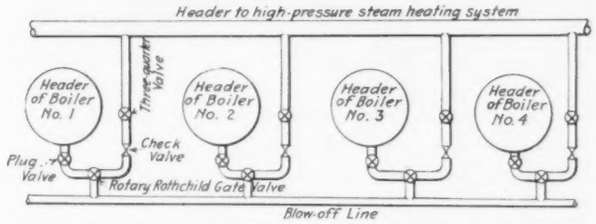
How to Make a Transformer for Low Pressures. By Prof. F. E. Austin. Northfield, Vt.: Northfield Publishing Company. 14 pages, illustrated. Price, 25 cents.

Electric Railway Handbook. By Albert S. Richey, assisted by William C. Greenough. New York: McGraw-Hill Book Company, Inc. 832 pages, illustrated. Price, $4.

POWER AND OPERATING SECTION

Steam-Heated Boilers as Aid to Quick Firing

Two generating stations of the Dayton (Ohio) Power & Light Company situated not far from each other are operated in parallel. Occasions arise when it is necessary to shift the majority of the load quickly to one plant or the other. At such times batteries of boilers must be brought into action quickly. To get high speed in boiler firing and at the same time to operate the station economically, a scheme for quick firing has been worked out, which provides principally for a steam-piping system arranged to keep the boilers hot when there is no fire on the grates. Steam for this purpose is taken from a header which feeds the company's high-pressure heating system. Ordinarily the pressure on this line is about 125 lb. gage.



STEAM PIPING OF BOILERS ARRANGED FOR QUICK FIRING

With a boiler connected to the system of piping, as shown in the accompanying sketch, the water is maintained at its normal level and the temperature kept at about 210 deg. Fahr. The furnace grates are covered with a fuel bed of oily rags, kindling and coal, and it is generally possible to get the boiler fired and onto the line in from three minutes to five minutes. In fifteen minutes from the time the fire is lighted such a boiler will be receiving its full supply of coal through the Taylor stokers and delivering its full-load rating. Without some sort of quick-firing arrangement a boiler, it is said, can hardly be made to deliver its full load in less than forty-five minutes from the time it is fired.

Triple-Frequency Currents in Delta-Connected Generator

After the windings of a 750-kw star-connected generator, the property of the Merchants' Heat & Light Company at Indianapolis, Ind., had been changed to delta connection it was discovered that the machine would overheat even though operating on open circuit.

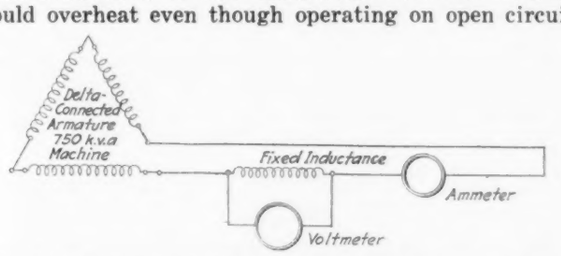


FIG. 1—MEASURING CIRCULATING CURRENTS IN DELTA WINDING

Further investigation disclosed the fact that when the machine was developing full normal voltage on open circuit there was being circulated in the delta-connected windings a current equal to 125 per cent of full-load current. Mr. R. J. Wensley, assistant engineer of the American Public Utilities Company, then opened the delta circuit and inserted an ammeter and a fixed inductance, as shown in the sketch herewith, connecting a voltmeter around the inductance. After taking simultaneous readings of the current through the inductance and the voltage drop around it, the engineers making the test placed the same inductance and the same instruments in a sixty-cycle circuit, passing the same value of current through the inductance that had flowed through it when it was connected in the delta winding.

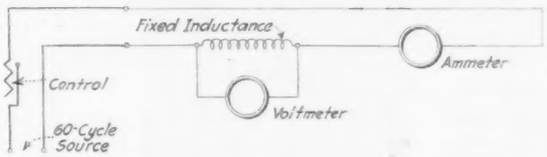
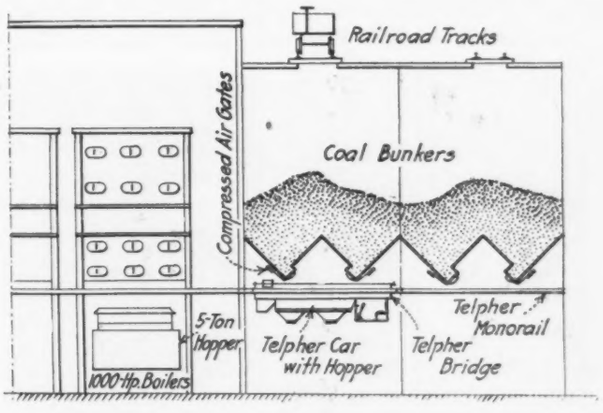


FIG. 2—CIRCUIT FOR MEASURING FREQUENCY OF HARMONICS

Reading the voltage drop around the inductance as it carried this current value in the sixty-cycle circuit, the investigators found the drop to be just one-third that which had been registered with the inductance in series with the delta. From this it was deduced that the frequency of the harmonics in the delta must have been three times the frequency of the sixty-cycle circuit.

Gravity-Telpherage Coal-Handling System in Cleveland Plant

An elaborate system of telpher monorail overhead tracks supplies coal to the five 1000-hp Stirling boilers in the municipal plant of the city of Cleveland, Ohio. The plant is situated at the water line 60 ft. below the shore level, and two coal-car spurs extend out over the roof of the bunker compartments. These bunkers hold 3500 tons and deliver their fuel contents to the telpher cars through forty spouts, each of which has an air-controlled gate valve. Having taken on its load, the telpher car moves over parallel to the boiler aisles until the transfer bridge is reached. Entering upon this, the bridge and car can be operated transverse to the aisles to reach the proper firing aisle. Each boiler hopper holds 5 tons, so that the telpher cars need make only occasional trips. The coal hoppers on the telpher cars are mounted on scale beams, enabling a record of the amount of coal fired to be obtained while making delivery. The telpher equipment was furnished by the Brown Hoisting Machinery Company, Cleveland.



GRAVITY TELPHERAGE COAL-HANDLING EQUIPMENT AT CLEVELAND

Emergency Cabinet for Electric Power Stations

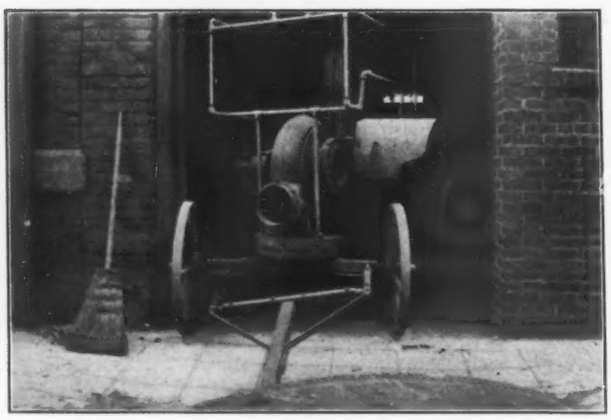
In all its stations and substations the Edison Electric Illuminating Company of Brooklyn, N. Y., has installed emergency cabinets similar to the one shown herewith. In the lower compartment is a collapsible

EMERGENCY CABINET

canvas cot and oxygen tank. In a smaller compartment at the top of the cabinet are a rubber pillow and a blanket. The door of the cabinet contains a glass panel which allows any one searching for first-aid equipment to see the contents of the cabinet. This door is kept sealed, and if the seal is broken it must be reported immediately. Attached to the case in a conspicuous position is a card requesting everyone giving aid to an injured person to telephone to the central office for a pulmotor in case one is needed. Near each cabinet is a bulletin describing methods of resuscitation from electric shocks, etc.

Portable Steam-Main Tunnel Ventilator

When it becomes necessary for workmen to enter the 6.5-ft. by 5-ft. tunnel in which the 30-in. riveted-steel steam-heating main of the Merchants' Heat & Light



WAGON EQUIPMENT FOR VENTILATING HEATING-MAIN TUNNEL

Company is laid at Indianapolis, Ind., use is made of an emergency ventilating outfit to reduce the torrid temperature of the underground duct. The ventilator consists of a 3-hp water-cooled gasoline engine, belted to a blower with an 8-in. exhaust and to a small electric-lighting generator. This entire apparatus is mounted on a light wagon truck, which in emergencies is hitched behind a wagon or a truck and hurried to the manhole nearest the scene of activities. After opening two manholes a blast of air is forced in one of them and out the other, passing en route the position at which work is to be done. A pair of flexible insulated wires, to which are attached several ready-rigged incandescent lamps, is run into the tunnel from the small generator, and in a short time after the emergency wagon has arrived on the scene this section of the tunnel is transformed into a fairly comfortable place to work.

A Permanent Water Gage to Show Forebay Levels

Existing water levels are quickly shown by the home-made gage illustrated in the accompanying halftone and used at the hydroelectric station of the Rumford Falls (Me.) Power Company. The gage indicates the height of water in the forebay, just outside the racks, meas-

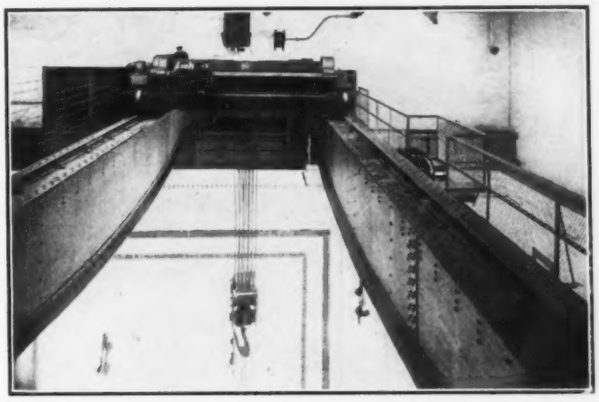
WATER GAGE USED BY RUMFORD FALLS (ME.) POWER COMPANY

ured with respect to elevation above sea level. The standard is secured to the concrete retaining wall of the forebay by an iron rod. Readings may be made in much less time than was formerly required to insert a portable sounding rod, and the size of the figures and scale make it needless for the operating man to lean over the rail or rack in order to take a satisfactory observation. Night readings are also facilitated when these are required.

Guards on Overhead Cranes for Protection of Operators

Most overhead cranes are constructed so that it is actually dangerous to cross over them to inspect any of the operating mechanism. Moreover, if the crane stops at other than a boarding point, the operator is usually compelled to walk back to the exit along the rail without any guard to prevent his falling to the floor below. These points have been considered by the United Electric Light & Power Company, New York City, which has provided very satisfactory guards to protect the crane operator in practically all of his maneuvers. First of all, a patform has been attached to the cage end of

the crane so that a person attempting to get on the crane will not have to step across the space over the running rail. Closing the opening below the hand-rail at the side of the footboard running across the crane is a wire network which prevents anyone slipping off the



WIRE-NET GUARD ALONG CRANE RAIL

footboard. Woven-wire netting has also been placed around the operator's cage as the railing initially provided was very low. Attached to the station wall about 4 ft. above the running rail on the cage end of the crane is a hand-rail which the crane operator can grip when it becomes necessary to walk along the rail.

Large Synchroscopes Facilitate Station Operation at Springfield, Mass.

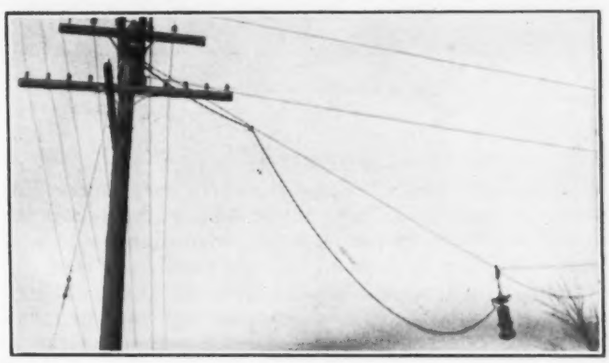
The operation of switching turbo-generators into service is greatly facilitated at the Springfield (Mass.) steam plant of the United Electric Light Company by the use of two large synchroscopes with dials about 3 ft. in diameter, mounted in the station wall about 15 ft. above the floor, as shown in the accompanying illustration. In this station three generators of about 11,000-kw rating are installed in one engine room, while three

LARGE DOUBLE-FACED SYNCHROSCOPE AND SIGNAL HORN

1000-kw units had to be installed in an adjoining portion of the plant, as a result of increases in the load during the last few years. The two synchroscopes are mounted back to back in a former window space, so that the operating staff on duty in each turbine room can co-operate in phasing in machines. The next wall opening contains an illuminated signal board, also double-faced. Two air horns mounted above the synchroscopes and controlled from the switchboard on a nearby gallery complete the equipment. Push-buttons in each turbine room enable the engineers to communicate with the switchboard operator, who can flash the load to the nearest hundred kilowatts on the indicator by a signal system installed by the Q-P Signal Company, Needham, Mass. The synchroscopes were built by the General Electric Company, Schenectady, N. Y.

Eliminating Swinging-Conductor Trouble

Instead of using two separate swinging conductors to supply energy to the arc lamps on its series circuits, the Crawfordsville (Ind.) Light & Power Company has adopted as standard a twin-conductor cable made especially for its arc-lamp service. A circular porcelain insulator hung from the messenger cable, as shown in the illustration, prevents the conductor from rubbing against the pole or cross-arm and damaging its insula-



TWIN-CONDUCTOR ARC-LAMP FEEDER

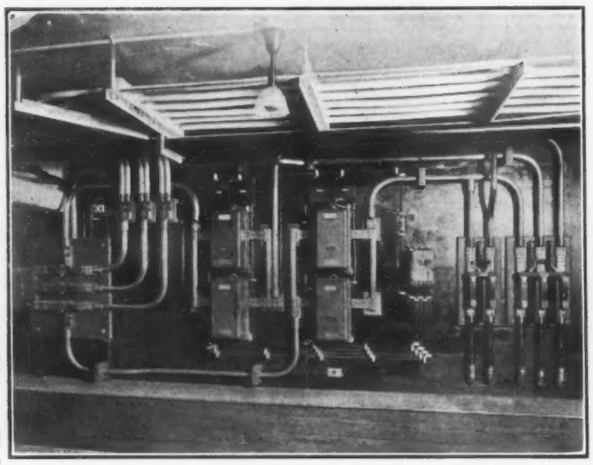
tion. Mr. F. H. Miller, manager of the Crawfordsville company, reports that local arc-lamp trouble has been much reduced since the installation of the new cables.

Compact Service Board in Boston Telephone Building

In taking over the service of the New England Telephone & Telegraph Company's Milk Street exchange building, the Edison Electric Illuminating Company of Boston, Mass., arranged to supply energy through an unusually compact meter board, as shown in the accompanying illustration. Prior to the adoption of central-station service an isolated plant of three 75-kw Western Electric engine-driven generators furnished electricity for lighting, battery charging and small power purposes. Two of these units have been retained by the telephone company for use in extreme emergency only. Continuity of service has been provided for by the Edison company by the arrangement of three wholly independent three-wire feeder circuits which approach the building by three different routes.

The first and second services are tied together as they enter the basement of the telephone building, while the third set enters from the Oliver Street side. All three are brought to a switch panel shown at the left of the illustration, where a horizontal, triple-pole, double-throw switch enables the building to be connected with either of the incoming feeds. From the service switch solid copper rods, 1.75 in. in diameter and of something over 2,000,000-circ. mil section, are

run to the watt-hour meters. Two meters are provided in each of the outer legs, paralleling being effected by flat connecting bars as shown, while the neutral lead is run directly from the central contact of the service switch to the main lighting control switch shown at the extreme right-hand end of the picture. The two-pole switch shown beside the latter controls all the 220-volt



ELECTRIC SERVICE BOARD IN MILK STREET BUILDING, BOSTON

power service of the building. Each switch has a rating of 1500 amp. By the use of copper rods space was saved in making up the connections on the board, although a little more copper was needed than would have been called for had straight runs been employed. A demand indicator is installed between the watt-hour meters and the motor-service and lighting switches. Service is purchased by the telephone company on a demand basis, an additional rate being paid for energy used above 120 kw. Care is taken by the telephone company not to exceed this demand in charging batteries, etc., and such charging is usually done when the lighting demands are low. The service board was designed by Densmore & Le Clear, Boston.

Soften Mica Before Turning Commutator Surface

To insure the production of a commutator surface on which there is no "high mica," said Mr. E. H. Martindale, of Cleveland, Ohio, before a recent meeting of the industrial power section of the American Institute of Electrical Engineers, the operator should first soak the commutator in oil over night before trying to machine its surface. It is also advisable, continued the speaker, to play a stream of oil on the point of the cutting tool while the commutator is being turned. Oil softens the mica and makes it cut more nearly like copper so that the work of the cutting tool is more nearly uniform.

Improving Motor Drive in a Corset Factory

On a recommendation of the motor-service engineering department of the Worcester (Mass.) Electric Light Company, the Corset H Company, of Worcester, has recently remodeled its motor installation. Before motors were installed the plant was operated by several direct-current motors suspended from the ceiling and driving the machinery by belts running upward through floor openings. This motor arrangement was troublesome to operators working underneath, and was, in addition, uneconomical of space, the distance between the center of the motor shaft and the driven shaft being only 4 ft.

In the rearranged layout ninety-six Singer factory-type sewing machines are driven in groups of twenty-four by four 3-hp, 550-volt, three-phase General Elec-

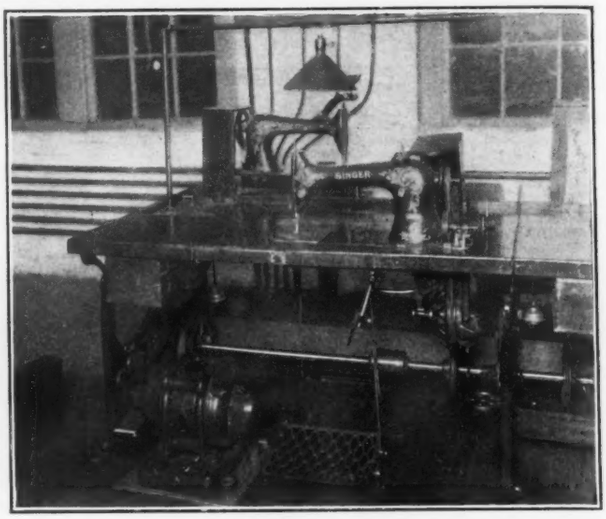


FIG. 1—THREE-PHASE 3-HP MOTORS DRIVING GROUP OF SEWING MACHINES

tric induction motors, bolted through floor pans and driving the machine line shafting as shown in Fig. 1. Each motor drives the shaft through a "Link-Belt" silent chain 1.5 in. wide, the motor speed being 1700 r.p.m. and the shaft speed 440 r.p.m. The motor pinion and gear on the shaft are of steel and are mounted only 14 in. between centers. To guard against the gear becoming loose, a keyway was cut on the shaft and the

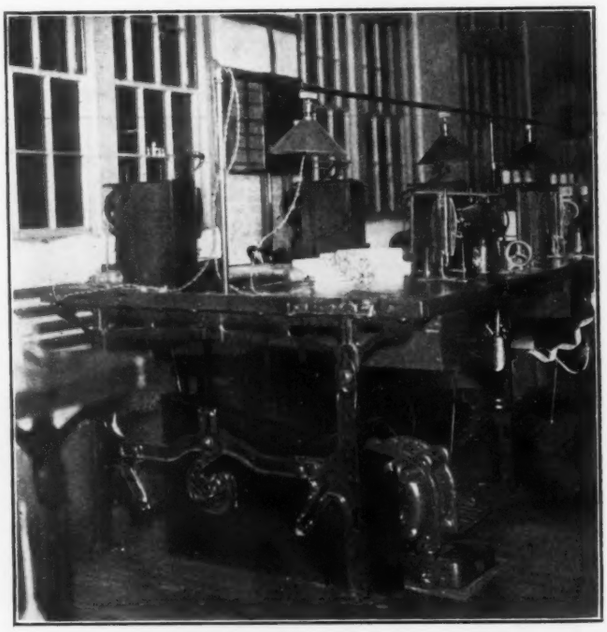


FIG. 2—PROTECTIVE HOUSING FOR CHAIN DRIVE TO SHAFT

gear bored for a set screw. When in operation the compactness of the drive is of great convenience, as the motors require practically no clearance space outside the working tables. As shown in Fig. 2, each chain drive is provided with a safety housing lined with galvanized iron, the guard being diagonally split to facilitate inspection of the chain.

COMMERCIAL SECTION

KANSAS CITY UNION STATION LIGHTING

Beautiful Effects Gained Through Simplicity of Design the Object of Which Is Utility and Efficiency

One of the principal problems which confronted the engineers of the recently completed Union Terminal Station, Kansas City, Mo., was the illumination of the structure and approaches. In the solution beauty, in places where beauty was required, was not sacrificed for utility, and the effects gained through the simplicity of the arrangements in all departments are all that could be desired.

The most attractive arrangement is to be found in the grand lobby and in the main waiting-room; still, some of the lighting effects of the rooms surrounding the grand lobby are pleasing. This is especially true of the inverted bowls in the main dining-room and the electroliers in the men's and women's rooms.

In illuminating the grand lobby the engineers kept to the plan employed in the main waiting-room of placing the lamps in decorative torch brackets. There are eight of these dull bronze torches surmounted with bright trimmings holding fifty frosted tungsten lamps together with three huge drops with their lowest point 38 ft. above the floor. These latter are 55 ft. in length and contain 150 lamps each, furnishing the illumination for this room with its 93-ft. ceiling. The torches used are 6 ft. in height and are secured to the side walls 37 ft. 6 in. above the floor. Four on either side of the room shed their light in such a manner as to reduce the shadows to a minimum.

In the main waiting-room the same plan and type of bracket is employed—twenty of the torches alone furnishing the illumination. These are fastened 25 ft. 6 in. above the floor. Throughout the corridors leading to and from the steps to the track level below tungsten lamps in reflectors are used, the reflectors being connected directly to the ceiling fixture outlet. This plan

FIG. 2—GENERAL VIEW OF CORRIDOR, SHOWING LIGHTING SCHEME

is employed in all departments where it has not been found necessary to bring the lamps closer to the floor in order to secure a more direct source of illumination.

In the train sheds all lamps—250-watt tungstens—are set in metal reflectors attached to the overhead structural ironwork. The lamps are spaced in such a manner as to bring them in line with the entrances and

FIG. 1—MAIN WAITING-ROOM OF KANSAS CITY UNION TERMINAL STATION

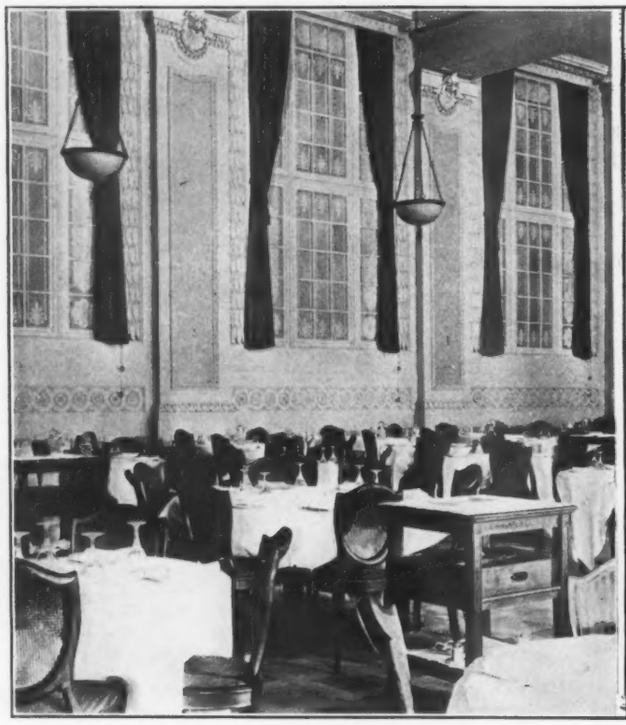


FIG. 3—A CORNER IN THE DINING-ROOM

FIG. 4—MEN'S SMOKING-ROOM

exits of the coaches of trains standing along the platform. In the mail, baggage and express rooms the 250-watt lamps are brought closer to the work by means of metal extensions.

A few nitrogen-filled lamps are being used in the power plant in the coach yards and for illuminating the approaches to the station from the outside. In most cases these are of the 1000-watt type, although a few 750-watt lamps are in use in the machine shops and workrooms of the Terminal company.

FIG. 5—DECORATIVE LAMP-POST AT FOOT OF STAIRWAY

In a few of the offices of the officials and main business departments of the station metal inverted hangers are used. These are of dead black suspended from the ceilings by metal chains of the same material. In the dining-room a pretty effect has been obtained by inverting the light by means of hanging bowls of cream color which are made to represent basket design. The interior of this room is finished in light colors, cream, light green and pink forming the color scheme; the draperies are of old rose, the floor of marble and the furniture of mahogany, so that the whole works out in a very attractive arrangement.

Throughout the entire station it has been the idea to obtain a standard of light, and this has worked out very successfully through the employment of large lamps in rooms of dull finish and by the use of frosted bulbs or deflectors in rooms of light, bright design. In the men's and women's rooms where the color schemes are all light and the trimmings of white marble the result obtained is a very highly developed combination of light. In order to subdue this at times when artificial illumination is required frosted bulbs set in electroliers of the drop pattern are used.

In the lunch room pedestals surmounted by rings of frosted lamps, augmented with clusters of four lamps set in bright bronze fixtures connected directly to the ceiling, furnish the illumination. The same type of ceiling fixture is employed in all of the shops about the grand lobby, including the drug store, news stand, curio shop and cigar store.

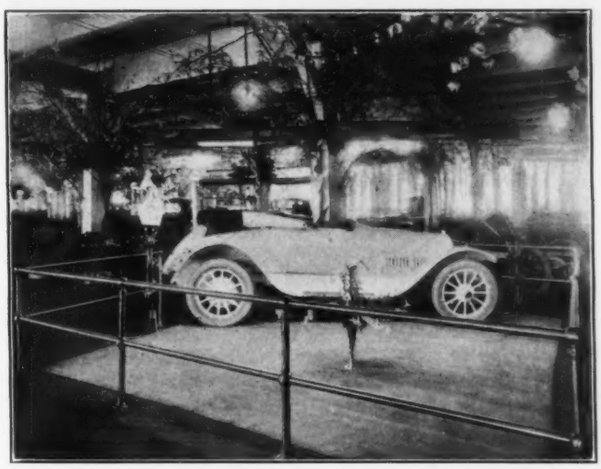
Very little ornamental lighting has been used about the exterior of the station proper or along the approaches to it. On the coping surrounding the areaways between the station wall and the sidewalk several bronze pillars surmounted with antique lanterns have been installed, and at the terminus of the Main Street viaduct at Twenty-fourth Street, the station front, a granite column at either side supports five high-power lamps in bronze fixtures. As for the station park, a plot of several acres directly in front of the main building between Main Street and Broadway, extending three blocks, columns conforming to those in use on the

exterior at present will in all probability be employed.

The lighting engineers have sought pleasing effects without leaning to the gaudy in the least, the whole design being worked out on lines offering the best illumination at a maximum distance at a minimum cost.

Flood Lighting of an Automobile Exhibit

At one of the recent Boston automobile shows an artistic installation of special lighting was made by the Buick Motor Company, as shown in the accompanying halftone, for the purpose of emphasizing the lines and finish of a new model roadster which was finished in white. The car was placed diagonally across the corner of a railed-in area about 18 ft. square, leaving about 60 per cent of the floor clear. About 9 ft. in front of the car were two ornamental troughs hung by chains about 8 ft. above the floor. Each trough contained six 150-watt tungsten lamps and was lined with a corrugated metal reflector. When the lamps were switched into circuit the car and the surrounding booth were beautifully illuminated by this flood lighting. The darker areas of adjacent booths proved the effectiveness of the arrangement, which was remarkably free from glare and was without question the most distinctive lighting in the entire show.



SPECIAL FLOOD-LIGHTING MADE THIS THE DISTINCTIVE EXHIBIT OF THE SHOW

Restrictive Ordinances Need Not Limit Effectiveness of Sign Displays

In spite of the fact that the electric-sign displays shown in the accompanying illustration are by city ordinance prohibited from extending out over the sidewalk, this corner of Madison and Clark Streets, Chicago, nevertheless presents a collection of large motion electric signs quite as spectacular as can be found in any similar wall space in the country. Some 8000 lamps are shown in the displays illustrated, the circuits being controlled by twelve flashers.

The proprietor of the billiard hall and bowling alleys on the upper floor has supplemented his motion sign depicting a man playing pool (which has been displayed on this corner for several years) with the energetic electric-lighted figure of a man bowling. The swing of the bowler's arm, the travel of the ball and the scattering of the pins are all reproduced with fidelity.

A striking effect is achieved by the restaurant owner through a 140-ft. line of tungsten lamps stretching across the Madison Street side of the building. The rapid "run" of the line of light along this border, ending in an arrow head pointing to the entrance way, never fails to attract the attention of the Madison Street crowds. The signs described were built by the Federal Sign System (Electric), the J. D. Ahern Company and the Haller Consolidated Company, all of Chicago, the flashers being furnished by the Reynolds Electric Company, Chicago.

ELABORATE ELECTRIC-LIGHTING DISPLAY WITHIN LIMITS SET BY LOCAL ORDINANCE

The Absolute Dependability of Central-Station Power

Along the lake front near an exclusive residential district in Milwaukee, Wis., there is a smokeless, attendantless and silent power house upon the unfailing operation of which depend the lives of workmen in a tunnel under the waters of Lake Michigan more than half a mile from the shore. The power house contains motor-driven compressors supplying air to the tunnel diggers. Ultimately the tunnel, which lies about 90 ft. deep, will extend 4000 ft. out under the lake to a crib or intake for unpolluted water, but so far the work has progressed only to about the 3000-ft. stage. During the operations the door of the power house has been padlocked and the operation of the machines has been entirely automatic. From this plant the air is delivered at two pressures, one for caisson work, and the other for driving pneumatic tools. Electrical energy is supplied from the lines of the Milwaukee Electric Railway

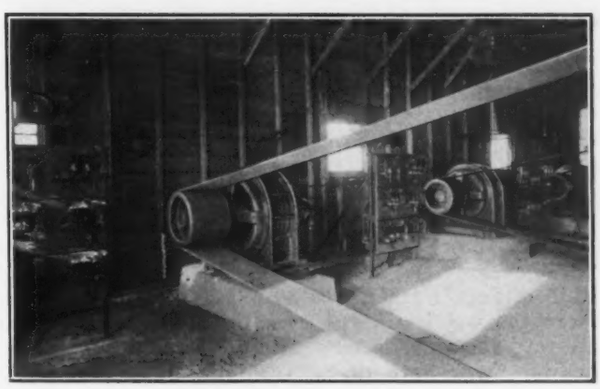


FIG. 1—ATTENDANTLESS MOTORS AND CONTROL PANELS

& Light Company through one 60-kw and three 75-kw, three-phase transformers.

Originally it was the intention of the contractor, Mr. Joseph Hanreddy, of Chicago, to use a steam-driven outfit to supply the compressed air for the tunnel workers, and, in fact, he had shipped a steam plant to the site and was ready to unload it from the cars when the possibilities of central-station electric service were

MOTORS AND MACHINES USED IN TUNNEL CONSTRUCTION

Number	Rating in Hp	Application
One	150	High-pressure air compressor
Two	100	Low-pressure air compressors
One	35	Centrifugal pump
One	25	Fan
One	37	Hoist
One	15	Concrete mixer
One	5	Various applications
One	25	
One	7.5	

pointed out to him by the Milwaukee company's new-business manager, Mr. R. B. Snyder. Considering the advantages of electric service and appreciating the saving it would effect, the contractor installed the machines listed in the table herewith. The outfit has been in operation about eighteen months, and at the beginning of the work the bills averaged about 15,000 kw-hr. a month. With work in the tunnel pushed to the 2500-

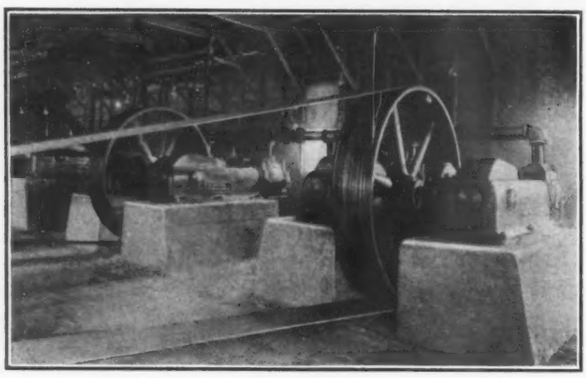


FIG. 2—COMPRESSORS BELT-DRIVEN BY ELECTRIC MOTORS

3000-ft. stage, however, 60,000 kw-hr. a month was required to operate the machines.

In the lighting of the tunnel use was made of 240-volt tungsten and graphitized-filament incandescent lamps in order to reduce the sizes of wire on the long lines and avoid the necessity of handling 2300-volt lines under the lake.

Utilizing Grain Waste from Breweries

Among the novel applications of electric motor drive in Philadelphia is the 50-hp installation of the Penn Grain & Seed Company, 3136 West Thompson Street, where the wet grain waste of breweries is converted into feed for animals. Electric power is used to pump the wet waste into tanks, from which it is dumped into a pit which supplies the presses where most of the liquid is extracted. From this press the grain passes into large cylindrical driers and after circulating through them is carried by a belt conveyor to a bagging room, where it is packed for shipment.

Breweries formerly experienced much difficulty in disposing of their grain waste, especially during the summer season. When pastures were good and farmers could find other feed, large quantities of the waste grain accumulated in the breweries and the owners were compelled to sell this material at a low price for fertilizer. The Penn company's plant is now being equipped with individual motor drive, replacing the steam plant formerly used.

The Electric Versus the Old-Fashioned Way

One of the oldest and most forceful selling arguments is that of comparison and contrast. The prospective customer's attention can almost always be gained and

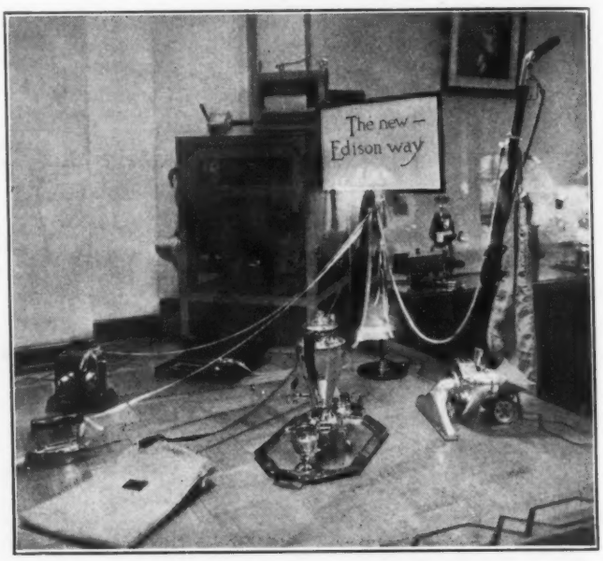


FIG. 1—TWENTIETH-CENTURY HOUSEKEEPING AT THE TOUCH OF A SWITCH

held most effectively by showing him "the better way." This elementary principle of salesmanship has been applied to advantage in preparing one of the recent window displays of the New York Edison Company, in

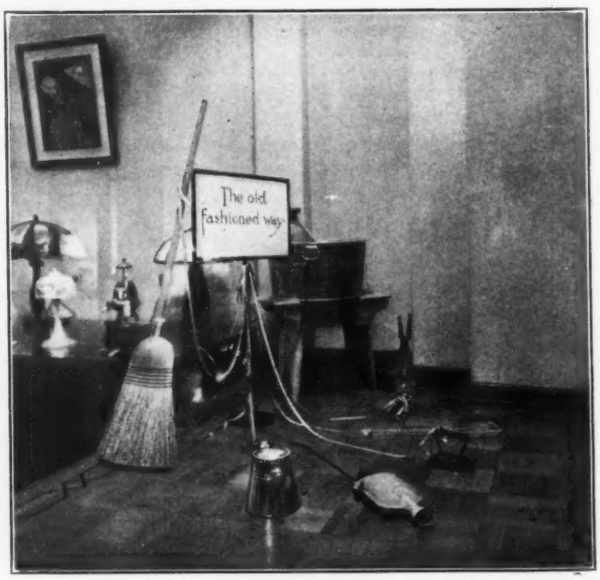


FIG. 2—RELICS OF HOUSEKEEPING OF A BYGONE PERIED

which two show windows, side by side, contrast old-fashioned back-breaking domestic methods with modern labor-saving electrical apparatus. This exhibit was first displayed in the Forty-second Street salesroom of the New York Edison Company, and will be shown in other districts of the city later.

NEW APPARATUS AND APPLIANCES

Sign Receptacle

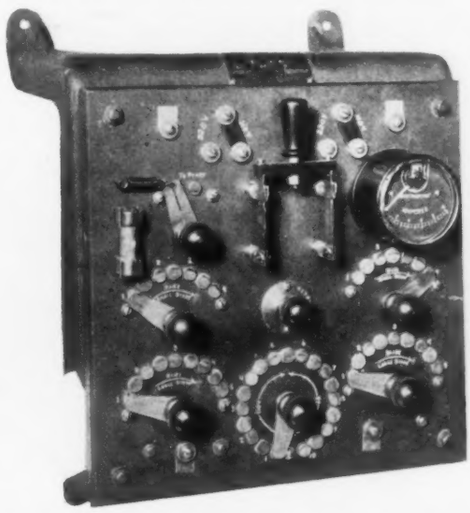
A receptacle for metal signs and outlet boxes has recently been developed by the Arrow Electric Company, Hartford, Conn. The screw shell is of a copper alloy designed to withstand corrosion, and when the receptacle is in place it can be removed from the front without disturbing the sign. A washer is placed under the

RECEPTACLE FOR METAL SIGNS AND OUTLET BOXES

head of the retaining screw to reinforce the shell. The binding screws are spun over, to prevent them from falling out. The distance from gasket to binding screws is 1 in. The receptacle is slotted and requires a hole 1.5 in. in diameter. It is rated at 660 watts and 250 volts.

Small Mercury-Vapor Charging Outfits

Small compact mercury-vapor outfits rated at 5 amp and 10 amp for charging gasoline-automobile starting and lighting batteries have recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The apparatus consists of a cast-iron wall bracket on the front of which is fastened a small slate panel having mounted on it the various switches and connections, a mercury bulb which is fastened to the rear of the panel, and a transformer and reactance coil which are the back of the bulb. The bulb is tilted for starting by means of a knob on the front of the panel. Adjustments to suit the different



FRONT OF PANEL FOR MERCURY-VAPOR CHARGING SET

numbers of cells to be charged are made by means of dials, for each adjustment the transformer connections being changed. The 5-amp set is designed to charge from one cell to eighteen cells, and the 10-amp outfit from one cell to thirty-six cells. Link connections are provided for adjusting the apparatus to either 110 volts or 220 volts.

Socket with a Plug Attachment

A type of socket designed for use wherever it is desired to operate an electric appliance from a socket outlet without removing the lamp is now being offered for sale by the Benjamin Electric Company, of 120 South

SOCKET WITH PLUG ATTACHMENT FOR HEATING APPLIANCES

Sangamon Street, Chicago, Ill. Primarily the device is a fixture socket. The rating of the plug attachment is declared to be sufficient to allow safe operation of any portable electric appliance. Control of the socket is effected through a switch lever made of insulating material. The sockets may be wired with the receptacle either in series or in multiple with the attachment plug.

Direct-Current Commutating-Pole Motors

Direct-current motors of the commutating-pole type with ratings of 1.25 hp to 39 hp, for operation at pressures from 100 volts to 530 volts, have recently been developed by the British Thomson-Houston Company, Ltd., Rugby, England.

The machines are made in four types, viz.: (1) A protected pattern in which the armature, field coils and other electrified parts are protected mechanically from accidental or careless contact; (2) an inclosed ventilated type which is provided with a perforated metal cover for the ventilating openings in the commutator end shield; (3) a "drip-proof" type in which the ventilating openings are protected so as to exclude falling or dripping water, and (4) a pipe-ventilated type which has four openings on the periphery of the armature end shields. In the latter type three of the openings men-

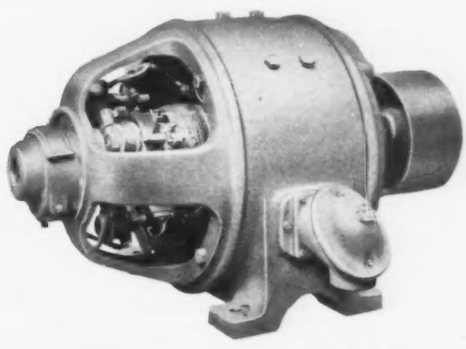


FIG. 1—PROTECTED MOTOR (COMMUTATOR END)

tioned are closed with solid cast covers, and the fourth opening is fitted with a flange-pipe intake.

The pulley ends of all the motors excepting the totally inclosed are protected by hooded end-shields with openings in the tops and bottoms of the shields. The totally inclosed type is provided with a solid pulley end-shield and has all four commutator-end-shield openings

inclosed with either sheet-metal or solid-cast-metal covers. The motors can be readily converted into the protected, inclosed, ventilated or drip-proof types by the substitution or removal of covers, while to convert them into the pipe-ventilated or totally inclosed types it is

FIG. 2—PROTECTED MOTOR (PULLEY END)

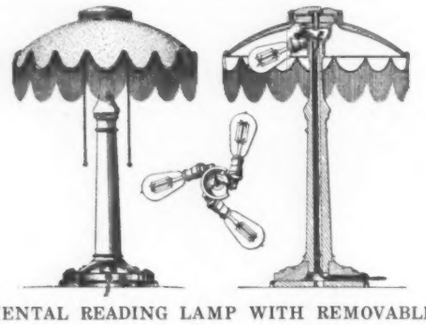
only necessary to substitute one or both end-shields respectively.

Ventilation is provided by a fan mounted at the back of the armature. The air is drawn through radial ducts in the armature core, the armature windings being protected from break-down caused by possible accumulation of dirt by slot armoring. The air then passes over the whole outside surface of the armature. The commutator is also provided with ventilating ducts.

According to the manufacturers, the motors are able to withstand momentary overloads of 100 per cent without injurious sparking or heating. All protected, inclosed-ventilated, drip-proof and pipe-ventilated motors are designed to operate for six hours with a maximum temperature rise of 72 deg. Fahr.

Table Lamp with Interchangeable Shades

The Rockford (Ill.) Light Furniture Company is marketing an ornamental reading lamp which is so constructed that the appearance of the lamp can be changed as often as desired by changing the silk shades. This attractive lighting unit, which is called the "Flood-o-lite" stands 22 in. high and rests upon an 8-in. base. The 2-in. shaft can be made of either mahogany or quarter-sawed oak. Beneath the Holophane reflector which is fastened securely to the upright shaft are ar-



ORNAMENTAL READING LAMP WITH REMOVABLE SHADE

ranged three pull-chain sockets with their lamps in an approximately horizontal position. The silk shade, which lies on top of the reflector, is not fastened to the lamp proper but can be lifted off at will. Patterns are furnished by the manufacturer with each lamp so that the purchaser can make or have made at a nominal cost as many shades as are desired.

Vest-Pocket Flashlamp

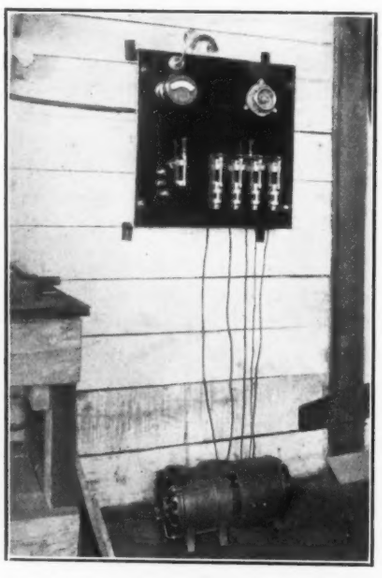
A flashlamp which is small enough to be carried in a vest pocket or in a handbag has recently been developed by the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago, Ill. The device is 5 in. long and $\frac{5}{8}$ in. in diameter. The switch of the flashlamp is used as a clamp to prevent it from slipping out of the pocket. The flashlamp is provided with a tongue de-

PHYSICIAN'S FLASHLAMP WITH TONGUE DEPRESSOR

pressor for use by physicians. This tongue depressor is removable and is nickel-plated. The case of the device is also nickel-plated.

Charging Sets for Ignition and Lighting Batteries

A small motor-generator set consisting of a single-phase motor and a shunt-wound generator, together with switchboard for charging ignition and lighting batteries on gasoline automobiles, is shown in the accompanying illustration. The set is started from the direct-current side, energy being taken from the battery. Use is made of a four-pole switch, the two middle clips of which are higher than the outside ones. The middle clips are connected to the battery, and at starting only these clips are engaged. When the set comes up to speed, the switch is thrown all the way in; the alternating-current motor then operates, and the outfit charges the battery. The batteries are charged in series, the charging current being varied by raising or lowering the field voltage. On the switchboard are mounted a starting switch, a volt-ammeter, a pilot lamp and a switching device arranged to switch from one

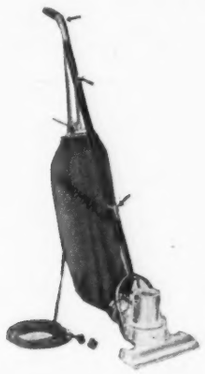


CHARGING OUTFIT FOR BATTERIES ON GASOLINE AUTOMOBILES

cell to the full number of cells for which the set is designed to charge, in series for charging. The outfit is being made in two sizes, the smaller being designed to charge from one cell to eight cells, and the larger from one cell to fifteen cells. The set was recently developed by the Lincoln Electric Company, Cleveland, Ohio.

Vacuum Cleaner with Vertical Motor

The electric vacuum cleaner shown herewith weighs 9 lb. and is equipped with a 1/6-hp vertical motor of the universal type which drives a six-blade steel fan. Use is made of a wooden pistol grip, and the handle is designed to stand upright when not in use. Control is obtained by a concealed push-button switch. Clips are provided on the handle for holding the cable when the machine is not being used. The nozzle is 12 in. long and is provided with slots to allow air to pass to the fan under any condition of cleaning. A rotary bristle brush is employed for the purpose of picking up lint, threads and litter.



VACUUM CLEANER CONNECTED TO VERTICAL 1/6-HP MOTOR

Various attachments are utilized for different cleaning operations. The height of the machine to the top of the motor is 7 in. The cleaner has recently been placed on the market by the Thurman Vacuum Cleaner Company, St. Louis, Mo.

Horizontal Edgewise Instrument

Instruments of the horizontal edgewise type for alternating current and direct current have been developed by the Hickok Electrical Instrument Company, Cleveland, Ohio, to meet the demand for meters which occupy small space upon the switchboard. As shown in the accompanying illustration, a comparatively large scale is provided. The length of the case is 8.5 in., the height 3.75 in., the depth 7.75 in., and the scale length 7.5 in. The weight of the device is 9.5 lb. The direct-current instrument is of the D'Arsonval type. The movement of the alternating-current instrument is of the dynamometer type. The dynamometer contains two coils, one coil being a fixed field coil and the other a moving coil which surrounds the field coil in such a manner that the resultant turning torque between the two coils is uniform, it is declared, throughout the movement of the coil through an angle of 90 deg., and gives a uniform scale in the wattmeter and a uniformly increasing scale in the voltmeters and ammeters. The framework is cast in one piece and is of insulating material; it contains a semi-circular chamber in which there is a light aluminum vane attached to the moving coil which answers the purpose of giving the instrument a dead-beat action.

HORIZONTAL EDGEWISE TYPE OF DIRECT-CURRENT VOLTMETER

Extension Swing Brackets

The swing bracket shown in Fig. 1 is of the pantograph type and the horizontal arm can be extended from a length of 24 in. to one of 42 in. By means of the wing-nut connection for the lampholder and reflector the angle of reflection is adjustable. The horizontal arm terminates in a T-piece, the lower half of which is cut away so that the weight of the arm causes the T-piece to grip firmly the upright on which it slides. No binding screws are required, and the arm can be moved up or down or swung around in a vertical plane.

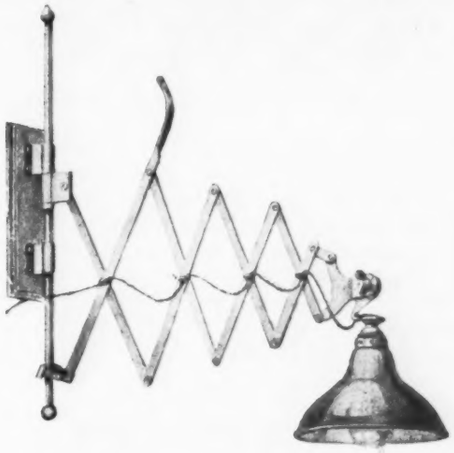


FIG. 1—EXTENSIBLE ARM OF PANTOGRAPH TYPE

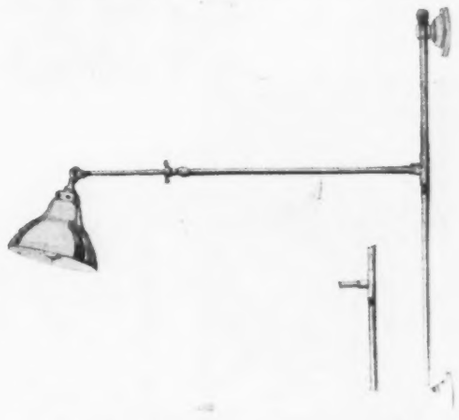


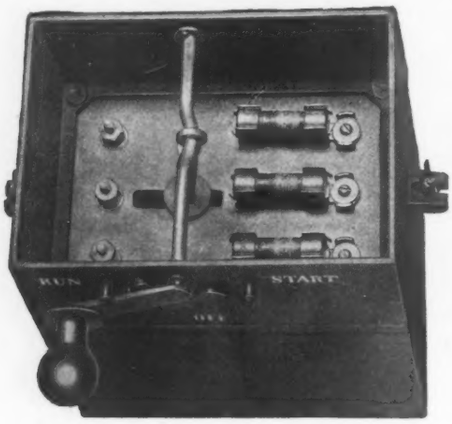
FIG. 2—EXTENSIBLE ARM WHICH SWINGS THROUGH ANGLE OF 180 DEG.

The arm of the bracket shown in Fig. 2 can be extended from a length of 8 in. to one of 32 in. and can be swung through an angle of 180 deg.

The extension-swing brackets described in this article are being placed on the market by the General Electric Company, Ltd., 67 Queen Victoria Street, London, E. C., England.

Oil-Filled Starting Switches for Induction Motors

To meet the demand for a fused oil switch for use in starting small induction motors, the Condit Electrical Manufacturing Company, Boston, Mass., has developed the oil starter shown herewith. The starter is designed

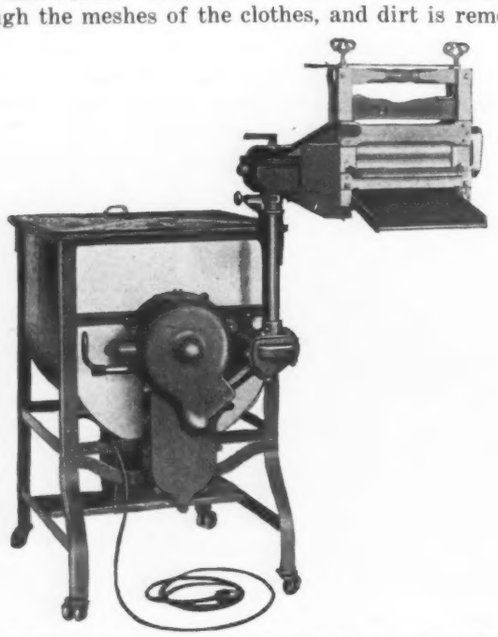


INDUCTION-MOTOR OIL-FILLED STARTER

for motors which take currents up to 30 amp at pressures of 600 volts or less. With this starter, the manufacturer claims, it is not necessary to have fuses with high ratings for the protection of the apparatus when the motor is started; proper overload protection can, therefore, be provided, it is declared, for running conditions. The device is totally inclosed and all contact parts are of heavy construction. A 250-volt oil starter is shown in the illustration.

Cylinder-Type Electric Washer

The electric washing machine shown herewith is provided with a perforated zinc cylinder which revolves back and forth. The hot water and suds are forced through the meshes of the clothes, and dirt is removed,



ELECTRIC WASHER WITH PERFORATED CYLINDER

it is declared, without rubbing or wear. The tub is of copper and is tinned inside. The wringer can be reversed and can be swung around to three different positions. It is equipped with a sliding drip board and a safety release device to prevent accidents. Both wringer and washer can be operated at the same time. Two levers are provided for starting, stopping or reversing either the washer or the wringer. Two machines of the type shown in the illustration are being made, one machine being designed to wash eight sheets or the equivalent and the other fourteen sheets or the equivalent at one time. The machines are being made by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa.

Table Fan

The electric fan shown herewith is provided with a glass bowl which can be removed if desired or may be employed as a centerpiece for a table. The fan operates on either direct current or alternating current. It

FAN WITH GLASS BOWL AS TABLE CENTERPIECE

is 10.5 in. high and 9.5 in. wide over all, and is finished in nickel and brass. A three-speed regulating device is provided for the control of the fan. The base is provided with rubber feet. The fan is being made by the Lindstrom, Smith Company, 1100 South Wabash Avenue, Chicago, Ill.

Electric Stoneware Instrument Sterilizers

Electric sterilizers of low-fired stoneware for physicians' instruments and similar articles are being placed on the market by the Santiseptic Manufacturing Com-

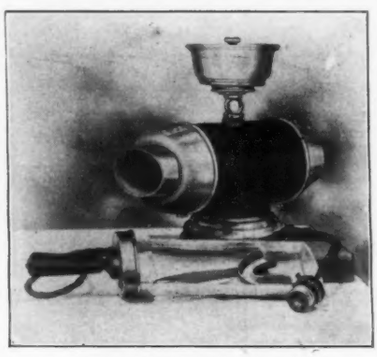


FIG. 1—STERILIZER WITH METAL CASE

pany, 64 Central Avenue, Tompkinsville, Staten Island, N. Y. The instruments are sterilized by means of radiated heat and superheated steam. The heating element is designed to raise the temperature of the sterilizing chamber to about 400 deg. Fahr. Water is introduced

in small quantities into the heating chamber, and on account of the high temperature the water is instantly converted into superheated steam. This steam acts as the principal heat-carrying medium. The steam condenses on the cold steel instruments, and in a few

FIG. 2—STONEWARE STERILIZER WITH WHITE-GLAZE OUTSIDE FINISH

seconds, it is declared, destroys all germs and spores without injuring the temper. A perforated tray is provided in which the articles to be sterilized are put before placing them in the heating chamber. Stoneware is an insulating and refractory material, and, the manufacturers claim, is capable of storing up great quantities of heat. In Fig. 1 is shown a sterilizer with a metal outside case. The inner tube containing the instrument tray is oval and is ⅜ in. wide and 2.25 in. high. The sterilizer shown in Fig. 2 is of a special stoneware which is provided with a white-glazed outside finish. The tray for this sterilizer is 3.25 in. in diameter and approximately 10 in. long. The Santiseptic company is also making a 450-watt sterilizer for the use of dentists and chiropodists.

Directly Connected Exciters

Instead of grouping a number of generators with a single bus and exciting them from a central direct-current exciter system, there is now a tendency to arrange the units in a station independently, so that trouble in part of the system will not cause a shut-down of feeders and apparatus other than those directly affected. Especially is this trend noticeable, it is claimed, in the case of hydroelectric plants where the energy is used

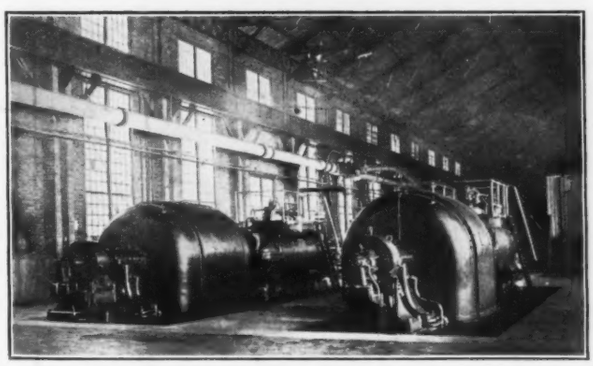


FIG. 1—EXCITER DIRECTLY CONNECTED TO HORIZONTAL GENERATOR

over a wide territory and must be delivered over long transmission lines. The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently developed several exciters adapted for such service. These units are of rugged construction. While the exciters are generally designed for use with the particular generator to which they are to be attached, the details of the construction are similar to those of steam-engine-driven direct-current generators made by the Westinghouse company. When utilized with a vertical genera-

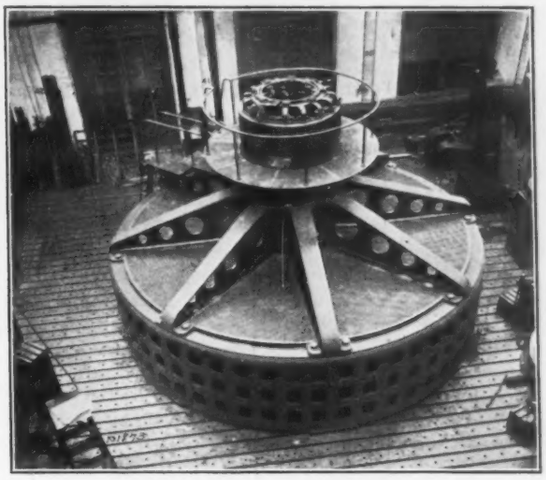
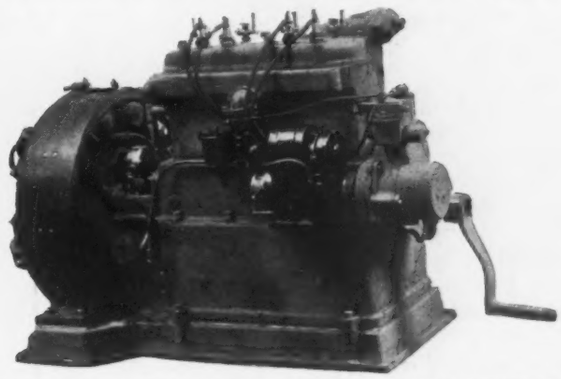


FIG. 2—EXCITER CONNECTED TO VERTICAL MACHINE

tor the exciter is carried by the thrust-bearing bracket. With a horizontal generator, the exciter frame may be mounted on an extension of the generator bedplate, on a bracket attached to the bearing pedestal, or on a separate base. The following advantages are claimed for the directly connected exciter: Each generator is dependent only upon its individual exciter; the number of auxiliaries is made a minimum; rheostat losses are reduced; belts and belting troubles are eliminated, and a neat and compact arrangement is secured.

Self-Contained Gasoline-Engine-Driven Generating Outfit

In the accompanying illustration is shown a four-cylinder, four-stroke-cycle engine directly connected to a ten-pole direct-current generator. The set is rated at 3 kw and operates at either 60 volts or 110 volts. The armature of the generator is utilized as a flywheel for the engine, which operates at a speed of 1100 r.p.m. The governor runs in oil and regulates the engine, it



GENERATING OUTFIT WITH ENGINE DIRECTLY CONNECTED TO GENERATOR

is declared, within 3 per cent from no load to full load. The fuel consumption is 3 pints per hour at no load and 6 pints per hour at full load. The lubrication is automatic and is provided by means of an oil pump operated from the cam shaft. The outfit is 34 in. long, 19.5

in. wide and 21.375 in. high. The manufacturer, the Universal Motor Company, Oshkosh, Wis., claims that the outfit is well adapted for motion-picture work, store and house lighting and automobile-battery charging, and for operating launches, wireless outfits and searchlamps, etc. The weight of the generator set complete is 450 lb.

Searchlamp Mounted on Truck for British Navy

Among the interesting developments which have come about as a result of the European war is the special searchlamp shown herewith, which was designed for the use of the British navy in its land operation. The searchlamp is mounted on a special truck, as illustrated in Fig. 1. The electrical plant was constructed by the Austin Motor Company, Ltd., Northfield, Birmingham, England. The truck on which the apparatus is mounted is equipped with a standard 3-ton chassis and a special body.

The generating set, which was also designed and constructed by the Austin company, is at the forward end of the body behind the driver's seat and is entirely distinct from the engine employed to move the vehicle. It comprises an Austin 12-hp two-cylinder gasoline engine directly connected to a generator operating at 120

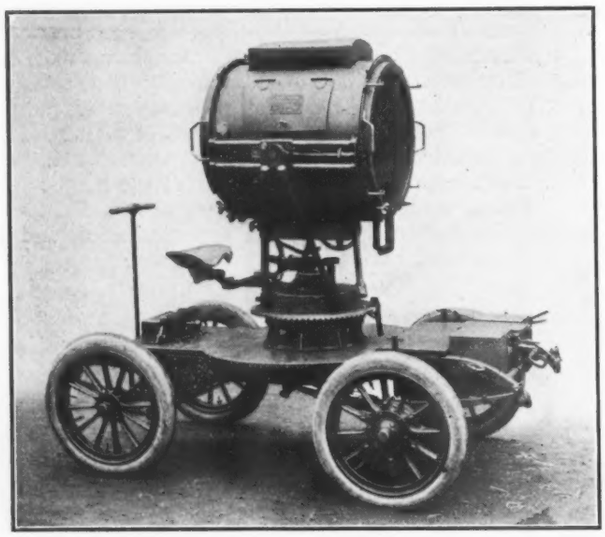


FIG. 1—THIRTY-INCH PROJECTOR MOUNTED ON SPECIAL TROLLEY

amp and 80 volts, at a speed of 1000 r.p.m. The engine is equipped with a special cooling system and exhaust-silencing chamber. In order to permit the searchlamp to be employed at any convenient spot some distance away from the motor truck on which it is transported, the special truck on which the projector is mounted is provided with pneumatic-tired wheels, and connection between the generator and the projector is maintained by cables wound on a drum carried on the truck. The drum is also equipped with ramps and tackle to permit the searchlamp with its trolley to be readily unloaded from and remounted on the motor truck. The trolley on which the searchlamp is carried is provided with brakes on its rear wheels. The projector, which was made by Crompton & Company, Ltd., Chelmsford, England, is mounted on a swiveling base, and also swings in horizontal trunnions. A seat which rotates with the projector is also provided for the operator. Both the horizontal and vertical movements are actuated by worm gearing which can be thrown out of gear to allow the projector to be quickly swung into the desired position.

Although the projector shown in Fig. 1 is only 24 in. in diameter, the generating set provided is designed to operate a 30-in. outfit. When not in use in conjunction with the searchlamp, the generating set can be em-

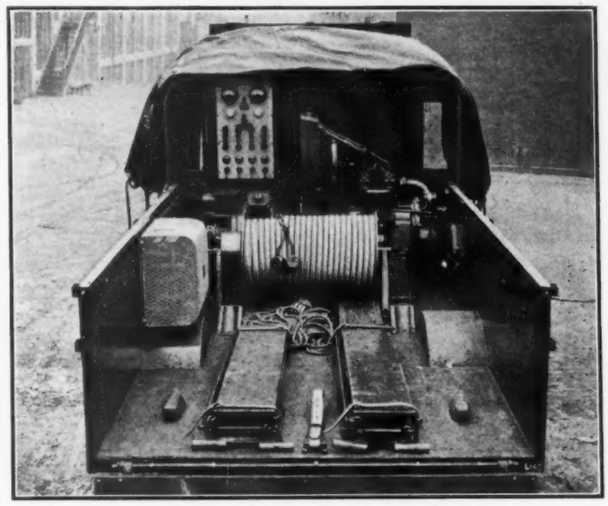


FIG. 2—REAR VIEW OF TRUCK WHICH CARRIES GENERATING SET AND SPECIAL TROLLEY

ployed for generating electricity for temporary officers' quarters, field hospitals, etc. The outfit includes a switchboard as shown in Fig. 2.

Gas-Filled Tungsten Lighting Unit

For a new semi-indirect lighting unit for gas-filled tungsten lamps, known as the "equalite," which has been placed on the market, the claim is made that it overcomes many of the objections to that form of lighting. The unit shown in the accompanying illustration consists of two members of "equalite" glass. The lower member, or dish, is 12 in. in diameter, is made of etched glass, and will give sufficient diffusion for units as high as 500 watts. The upper member, made of polished glass, is 16 in. in diameter. It acts as a

SEMI-INDIRECT LIGHTING UNIT FOR GAS-FILLED TUNGSTEN LAMPS

reflector, protects the dish from accumulations of dust and diffuses the light thrown upward so that the ceiling illumination will be uniform. The unit is manufactured by Messrs. Bayley & Sons, Inc., Brooklyn, N. Y.

CURRENT NEWS SECTION

Meeting of Electrical Manufacturers' Club

The spring meeting of the Electrical Manufacturers' Club was held at The Homestead, Hot Springs, Va., on May 5 to 8. About sixty-five members were present, making the meeting the largest spring gathering in the history of the organization. Mr. Walter Cary, Westinghouse Lamp Company, New York, the president, presided.

Among the subjects discussed was that of co-operation between the different organizations of manufacturers. A committee of five was appointed to confer with similar committees of the Associated Manufacturers of Electrical Supplies and the Electric Power Club. Consultations will be held between the three committees of these organizations to determine what lines of co-operation can be developed between the two older clubs and the newly formed association. The chairman of the committee is Mr. George A. Cragin, American Steel & Wire Company.

Mr. H. B. Crouse, Crouse-Hinds Company, Syracuse, N. Y., delivered an address on the general subject of "The Relation Between the Manufacturer and the Distributer." His talk was along somewhat the same lines as his similar address before the Electrical Supply Jobbers' Association in Chicago on March 25.

Mr. Walter Gordon Merritt, of New York, general counsel of the Anti-Boycott Association, discussed the situation arising from the indictment of forty-one electrical contractors and eighteen officials of labor unions in Chicago. This case was noted in the ELECTRICAL WORLD of May 1, 1915, page 1141. Mr. Merritt, as general counsel of the Anti-Boycott Association, is in charge of the case.

Deep regret was expressed at the recent death of Mr. C. F. Hills, formerly commissary of the club. The following committee, composed of five ex-presidents of the club, was appointed to draft a resolution and present it to the family of Mr. Hills: Messrs. S. O. Richardson, Jr., chairman; W. C. Bryant, D. R. Bullen, George A. Cragin and B. M. Downs.

As the annual meeting to be held in the fall of 1915 will celebrate the decennial of the club, a special program will be prepared for the occasion.

Electricity on Battleships and Submarines at New York Review

Outline-lighting displays of unusual beauty have marked the presence of sixteen first-class battleships and numerous cruisers, destroyers and submarines of the Atlantic fleet in the Hudson River, opposite New York City, during the present week. After nightfall the great dreadnaughts appear outlined in thousands of incandescent lamps which faithfully reproduce the lines of hulls, masts, turrets, guns and stacks. Adding to the brilliancy of the picture on gala occasions, the hundreds of searchlamps of the fleet are employed to weave designs against the night sky for the benefit of the tremendous crowds who throng Riverside Drive for a glimpse of the vessels.

Despite the presence of the larger ships-of-war at anchor near by, principal interest has been everywhere manifested in the flotilla of submarines, which includes several of the "K" class of vessels, the largest and fastest now in the service of the United States Navy. Like all submarines, these vessels are operated by electric storage batteries when running underwater. The "K" boats have a maximum submerged radius of 100 nautical miles and a maximum underwater speed of from 10.5 knots to 11 knots, the twin-propeller motors meanwhile developing a total of 650 hp at this full-speed rating. Lead storage batteries are used. When cruising on the

ONE OF THE U. S. NAVY'S BATTERY-DRIVEN SUBMERSIBLES NOW IN THE HUDSON

surface, the 900-hp Diesel oil engine with which each "K" boat is equipped makes possible a speed of 14 knots. Sufficient oil fuel can be carried for a cruise of 5500 miles. Several of the submarines now in New York made the 1500-mile run up the coast from Florida without incident under their own power. The present submarine flotilla of the United States totals about thirty-five submersibles in actual commission, while others building and undergoing overhauling bring the entire number up to fifty-five.

Patent Suit on Tuning in Radiotelegraphy

On May 5 Judge Van Vechten Veeder, of the United States District Court, Eastern District of New York, at Brooklyn, began the trial of an equity case brought by the Marconi Wireless Telegraph Company of America against the Atlantic Communication Company. The defendant corporation is generally known as the American representative of the Gesellschaft für Drahtlose Telegraphie, of Berlin, manufacturers of the German "Telefunken" wireless-telegraph apparatus. The Marconi company contends that the defendant's powerful stations at Sayville, L. I., and aboard certain United States vessels (including the *Herman Frasch*) are infringements of United States patents No. 609,154, issued to Sir Oliver Lodge in 1899, and No. 763,772, of Guglielmo Marconi, dated June 28, 1904. A great

deal of interest is being shown in the case, since the two patents, as sustained by Judge Veeder in his opinion of March 17, 1914, cover valuable and, in fact, almost essential elements of modern radiotelegraph systems. Dr. Marconi has come from England to testify as to his early work, and Professors Braun and Zenneck have been brought from Germany to assist the defendant company.

In the opening of the case the Marconi company presented evidence of infringement, in the testimony of two engineers employed by the plaintiff and of Mr. Frank N. Waterman, who explained in detail the patents in suit.

On Friday, May 7, the defense opened its case by putting on the stand its expert, Mr. Greenleaf W. Pickard. Mr. Pickard took up the prior art, going to great length in explaining publications of della Riccia, Tesla, Lodge, Braun, Pupin and Stone. It is understood that early work of these several investigators forms the basis for a defense of invalidity of the patents by anticipation, and that the defendant also claims non-infringement under the construction given to the patents in the previous suit before Judge Veeder.

Complete wireless-telegraph apparatus has been set up in court in order to illustrate various points of the case, and on Monday, May 10, radiograms were transmitted from the courtroom to the government station at the Brooklyn Navy Yard. Cross-examination of Mr. Pickard was commenced on Tuesday, May 11.

The attorneys for the Marconi company are Mr. Livingston Gifford, of Gifford & Bull, and Messrs. L. F. H. Betts, H. G. Ogden and J. W. Peters, of Sheffield & Betts. Those for the defendant are Messrs. Frederick P. Fish, Harry E. Knight, Philip Farnsworth and Walter Pumphrey. The case is expected to continue at least through the present month.

N. E. L. A. Staff Leaves for Convention

Secretary T. C. Martin of the National Electric Light Association and members of the association staff left New York on May 14 for San Francisco in order to prepare for the convention to be held on June 7 to 11. They will stop at San Diego in order to see the lighting features of the Exposition and will then go on to San Francisco. The headquarters office in the Native Sons' Hall will be opened on May 24. Arrangements for the convention are in a very advanced state. The headquarters of Mr. Martin will be at the Hotel St. Francis.

President Holton H. Scott will leave New York on the "red special" on May 24. He will leave the party, however, at San Diego so as to get to San Francisco a week before the convention opens. Of the officials of the association there will also be in attendance at the convention three of the vice-presidents, Messrs. E. W. Lloyd, H. A. Wagner and L. D. Gibbs, and a large delegation of members of the executive committee and past presidents.

Cleveland Municipal Plant Developments

Director of Public Service Sidlo of Cleveland has sent a communication to the Ohio Public Utilities Commission asking that the Cleveland Electric Illuminating Company be ordered to furnish $1,000,000 additional security to protect patrons who are charged more than the maximum rate of 3 cents per kw-hr. named in an ordinance passed by the City Council a year ago, from which the company appealed to the commission. Mr. Sidlo estimates that the company has collected at least $1,106,545 in excess of this rate, or $106,545 more than the bond that it gave when it appealed to the commission. The commission announced that a bill has been introduced in the Legislature which, if passed, will provide sufficient money to make the valuations of this and other utility properties.

A debate took place between Mayor Newton D. Baker and Councilman W. S. FitzGerald at a committee meeting last week over a resolution demanding that the Public Utilities Commission order the company to make a statement of its earnings above the 3-cent rate named in the ordinance. Mayor Baker asserted that the conduct of the company in refusing to make a statement to the Council has been "scandalous to the highest degree." His argument was that people have a right to know just what its earnings have been. Councilman FitzGerald said that the resolution had a political tinge, and that the city had set a bad example by refusing to open the municipal light-plant books to public inspection.

Investigation of Underwriters' Laboratories, Inc.

Reports from Chicago say that the Department of Justice has under consideration charges that the Underwriters' Laboratories, Inc., is conducting operations in infringement of the Sherman anti-trust law.

In a case decided several weeks ago by the Appellate Division of the Supreme Court of New York, the practices of the Underwriters' Laboratories, Inc., were under consideration. The judgment of the lower court, dismissing the suit, was upheld. The case was that of the Gutta Percha & Rubber Manufacturing Company against Mr. Charles J. Holman, as treasurer of the National Board of Fire Underwriters.

Convention of Fire Protection Association at New York

The nineteenth annual convention of the National Fire Protection Association, held at the Hotel Astor, New York City, May 11, 12 and 13, opened with an attendance of approximately 250. The report of the secretary showed a total membership of 2725, a net gain of 90. In his opening address President Robert D. Kohn reviewed rapidly the work of the association during the year, making special reference to the furthering of a bill, drafted by the association, to place the responsibility for damage by fire upon the owner of the premises in cases where a fire is the result of his negligence. The bill in a modified form has already become a law in Pennsylvania and has passed the lower house of the Minnesota Legislature. The first two days of the convention were devoted mainly to committee reports offering recommendations for blower systems for heating, ventilating and stock conveying, for fire-resistive construction, for proper use of wood in building construction, for automatic sprinklers, for the standardization of pipe and pipe fittings, for the storing and handling of explosives and combustibles, etc.

In the electrical committee's report, presented by Mr. F. E. Cabot, Boston, reference was made to the committee's recent work on the National Electrical Code, the fact being mentioned that in formulating the revisions particular effort was made to reduce life hazards.

Electric-Railway Construction Matters

In the report of the committee on electric-railway light and power plants, presented by Mr. C. H. Patton, Cleveland, chairman, the general status of railway construction was considered. The recommendations of the American Electric Railway Association for the construction of carhouses and other railway properties were indorsed by the committee. It was also recom-

mended that the labeling service of the Underwriters' Laboratories be extended to car-wiring installations.

Signaling and Fire-Alarm Systems

In the report of the committee on signaling systems, presented by Mr. Ralph Sweetland, Boston, chairman, signal systems were considered in detail, and the recommendation was made that signal wires have an approved rubber insulation at least 1/32 in. thick and an approved substantial braid, except in the case of open work in dry places and in the case of tubing or wooden-molding installations. This part of the report was accepted without debate.

The second part of the report recommended regulations for fire-alarm systems for use in factories, workshops and institutions where the occupants are under discipline and control. In addition to the general principles of operation and installation of such systems, the duration of signals, alarm-box, signaling-device and relay construction, sources of energy, wiring, etc., were discussed. One rule proposed provides that not more than one class of fire-alarm boxes be installed in a factory building. Automatically operated circuit-breakers and engine stops for shutting down noisy machinery in certain types of premises are recommended. The report also limits the current for the transmission of an alarm to a minimum of 100 milliamperes in the case of an all-closed-circuit system and to 50 milliamperes in the case of circuits containing boxes only. Non-interference types of alarm-box handles are specified. In the case of storage-battery-operated systems the potential is limited to 50 volts with a current of 1 amp in any part of the system. As 1-amp fuses are specified for normally closed circuits, the current for such systems is limited to this amount. Another recommendation states that dry cells shall not be used to supply actuating energy in any closed-circuit system excepting supervised systems.

The reading of this report brought forth considerable discussion, the feeling being expressed that the recommended rules were too drastic in numerous cases and would not permit approval of some desirable systems manufactured and in use at the present time. Most of this discussion centered around the limitation of the voltage and current in storage-battery systems and the proposed rules covering the use of dry cells. The report was, therefore, referred back to the committee with instructions to invite and consider suggestions for improvement, and after revision to submit the report to the executive committee, which was given full power to adopt the report or merely to accept it as a progress report.

Voting Privilege at Code Revisions Withdrawn

The executive committee's report, which was adopted, stated that the privilege accorded interested persons of voting at the meetings of the electrical committee held for the purpose of revising the National Electrical Code had been abused and would therefore be withdrawn.

Luncheon with New York City Officials

At the luncheon on Wednesday Hon. George McAneny, acting Mayor of New York City, welcomed the association to the city and laid emphasis on the value of its work. Fire Commissioner Adamson stated that he had received assurances that the rates for insurance would be substantially decreased when the new fire-alarm system is installed, the total saving due to the reduction in insurance rates being greater in amount than the interest on the investment necessary for the new system. Mr. J. E. Latta, Underwriters' Laboratories, Chicago, exhibited several reels of motion pictures illustrating the methods employed in testing materials, devices, etc., at the laboratories.

ELECTRICAL DEVELOPMENT MEETING

Members Are Told at Annual Gathering About Work of the Society and "Electrical Prosperity Week" Campaign

The annual meeting of the Society for Electrical Development, Inc., was held at the United Engineering Societies Building, New York, on May 11. General Manager J. M. Wakeman read his report and Messrs. H. W. Alexander, director of publicity, and A. J. Edgell, of the display service bureau, gave illustrated addresses on the work of the society. One of the society's motion pictures, "This Is the Life," was shown. Mr. Henry L. Doherty, president of the society, presided. He commented on what it had done and what is to be accomplished by the "Electrical Prosperity Week" movement.

The report of Mr. Wakeman said in part:

Report of Mr. Wakeman

"Section No. 1, which is devoted to field co-operation work under the direction of Mr. George B. Muldaur, has been particularly active. Mr. Muldaur or his assistant has visited every city of 100,000 population or over in the United States, besides a great number of smaller cities and towns; local committees have been appointed in most of them, and a good deal has been accomplished in harmonizing local interests where they have been in conflict.

"Section No. 2, in charge of Mr. J. P. Mallett, has been investigating the uses of electricity in its latest applications and most improved methods. He has been collecting information as to the uses of electricity in the various industries, and a great mass of valuable information of this character is now in our files, where it is available for our members.

"Section No. 3, in charge of Mr. Theodore Dwight, has the task of collating, filing and indexing the statistics and other information gathered for the use of our members, and as a part of the necessary work this section scrutinizes carefully the electrical and other technical papers from which much of the information in our files is collected.

"Section No. 4 is a large section with a number of varied activities. It is now in charge of Mr. H. W. Alexander, who became connected with the society the first of this year. Co-operative advertisements have been prepared and sent out to our members. Electric-railway cards, poster stamps, books containing selling suggestions, booklets describing all the electrical appliances available for use in the home, etc., have been issued to our members, and large quantities have been sold to members, at cost, for distribution as aids in their selling campaigns. This section provides the daily newspapers, trade papers, popular magazines, etc., with news, special articles and interesting stories pertaining to the uses of electrical energy. It has been particularly active in supplying stories to the various trade papers outside of the electrical press, in each case supplying special articles pertaining to the uses of electrical energy in the industry covered by the trade paper to which they are supplied.

"Another part of the work of Section No. 4 is the display service bureau, which is managed by Mr. A. J. Edgell, the president of the Greater New York Display Managers' Association. Every month a window is trimmed, suitable for the season, and covering, as far as possible, all the electrical devices available for use in the home. Halftone reproductions of the window setting and of the completed window are sent to our members with instructions how to obtain the results shown, always aiming at making the result effective but inexpensive to obtain.

"In this connection it should be borne in mind that

the Society for Electrical Development is the only organization in the electrical field in which the men engaged in all the different branches are represented on the board of directors and executive committee with a view to bringing about a closer co-operation of all the interests, and this feature in itself justifies the existence of the society. The only other electrical body to which all classes are eligible is the Jovian Order. This is closely allied, and should be even more closely allied, with the Society for Electrical Development.

"It has been suggested, and the suggestion has been approved by the board of directors, that the society should maintain a representative on the Pacific Coast.

"Electrical Prosperity Week"

" 'Electrical Prosperity Week' will be held from Nov. 29 to Dec. 4 inclusive this year, the underlying idea being to arouse the interest of the public in the uses of electrical energy and at the same time, through the campaign connected with it, to bring about a more optimistic feeling throughout the country and to give the men connected with the electrical industry the honor of leading in a movement which is intended to dispel the hard-times bogey.

"We need optimism; business needs boosting; people not only need their attention called to the possibilities of our own industry and what it means to them, but, judging from the expressions of opinion from manufacturers and merchants in other lines, the country needs arousing, and we have the promise of the hearty support and co-operation of other industries in our efforts in this direction.

"It is confidently expected that with the co-operation of the boards of trade, chambers of commerce and the members of our society throughout the country we shall have all the towns and cities brilliantly lighted during that week, special white-way lighting in the principal business streets, special lighting in the store windows, etc., with special displays, not only of electrical, but of all merchandise, so that we will blaze the road to prosperity from coast to coast.

"When I have presented this matter to clubs and organizations outside of the electrical industry I have dwelt upon the fact that the electrical men of this country have undertaken to do this great work, not in an entirely selfish spirit, but for the benefit of every manufacturer and merchant in every line of work throughout the country, and the electrical men have been thanked and commended for their enterprise.

"It is interesting to note that the men engaged in the electrical industry in Great Britain have been watching the work of this society with so much interest and satisfaction that they have incorporated a similar society in London, and we are now negotiating with them to carry on an 'Electrical Prosperity Week' throughout the United Kingdom at the same time that we are holding it in this country.

"We have been devoting our time to performing the work for which this society was organized, rather than trying to keep the society before the industry.

New Members

"The time is ripe now for us again to take up the work of securing new members. I should like to call attention to the fact that we are in a position to do very much more efficient work from now on than has been possible during the past few months because we have had to determine what we could do, how we could do it, to find the men to perform the work, and, inasmuch as this sort of thing had never been attempted before, it all had to be constructed out of the imagination and brains of the men who have devoted their time and attention to it in your interests. We have a well-organized staff, composed of good, sound, practical men, endowed with good common sense, deeply interested in their work and full of enthusiasm. We know more about the situation than we did when we began; we are better equipped to handle the various problems which present themselves from day to day.

"It is in order, I believe, to refer here to the fact that the board of directors and executive committee have expressed their satisfaction with the efficiency of the work of this society and their gratification at the economy with which it has been carried on.

Electrical men and retail merchants of Toledo and other northern Ohio cities met at the Commerce Club, Toledo, on the evening of May 6 to hear about the "Electrical Prosperity Week" campaign. About 275 were present. The meeting was held under the auspices of the Toledo Jovian League. Mr. E. R. Kelsey, publicity manager of the Toledo Railways & Light Company, acted as chairman. Mr. Guy H. Oliver, tribune of the Toledo Jovian League, called the meeting to order and introduced Mr. Kelsey, who is also secretary of the Toledo Rotary Club.

Mr. J. M. Wakeman, general manager, and Mr. Harry W. Alexander, director of publicity of the society for Electrical Development, were the principal speakers. Mr. Frank R. Coates, president of the Toledo Railways & Light Company, indorsed the work of the society and the plans for the sales campaign.

Staff for "Electrical Prosperity Week" Campaign

The Society for Electrical Development has added to its staff Messrs. John T. Kelly and C. Ridderhof.

Mr. Kelly has resigned as Eastern publicity manager of the Panama-Pacific International Exposition to become editor of the "Electrical Prosperity Week" campaign news bureau. He will handle the general news service, besides assisting in the co-operative work with chambers of commerce. Mr. Kelly was formerly a political writer on the New York *Evening World*, and also served in an editorial capacity on the Buffalo *Courier*, St. Louis *Republic* and Washington *Post*. Under the pen name of "Gilbert K. Harrison," Mr. Kelly has written stories of the West and its attractions.

Mr. Ridderhof, who resigned recently his position as advertising manager of the Hotpoint Electric Heating Company, will handle the advertising work for "Electrical Prosperity Week."

The campaign executive committee will have the assistance of advisory committees comprising commercial men in the industry, who will serve without compensation.

Mr. J. A. Randolph, industrial power engineer for the New York Edison Company, is to prepare technical and trade press articles on the industrial power applications of electricity. Miss Grace T. Hadley, formerly associate editor of *Popular Electricity*, will write of the application of electricity to the home. Miss Hadley is to be household editor of the society's department on home economics. Mr. A. J. Edgell, vice-president of the International Association of Display Men, will handle the details of the illumination end of the campaign and the co-operative work among merchants and civic associations. He now has charge of the display service bureau of the society. Mr. Harry W. Alexander, director of publicity for the society, will have charge of all publicity and sales work. Mr. Alexander was formerly publicity and merchandise sales manager of the Federal Light & Traction Company.

Mr. J. M. Wakeman, general manager of the society, will have entire charge of all the details of the campaign under the direction of the directors and the "Electrical Prosperity Week" executive committee.

NEW YORK STATE CONVENTION

Central-Station Men of Empire State Discuss Public Policy, Hydroelectric Developments and Small-Customer Service

Features of the joint meeting of the Empire State Gas & Electric Association and the Eastern New York Section of the National Electric Light Association, held at Schenectady, May 6, 7 and 8, were the addresses of Mr. James O. Carr, newly appointed member of the Public Service Commission for the Second District of New York, on "Public Policy," and of Dr. W. S. Stratton, director of the Bureau of Standards, Washington, D. C., on the work of the bureau and its connection with industrial development. There were also interesting general discussions relating to the financial, engineering and commercial aspects of hydroelectric development and plant operation and to the economics of small-consumer business. Mr. Henry Flood, Jr., electrical engineer of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., opened the discussion on hydroelectric development by reading a paper entitled "Hydroelectric Power—Its Generation and Distribution." At the commercial session Mr. A. D. Dudley, commercial manager of the Syracuse Lighting Company, presented a paper which he had prepared on the subject of "The Small Consumer—A Problem."

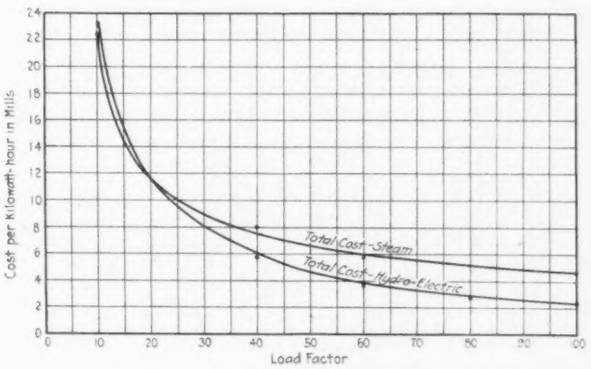


FIG. 1—COMPARISON OF TOTAL COSTS—STEAM AND HYDROELECTRIC

A well-attended banquet was held at the Mohawk Golf Club on Friday evening. Mr. J. C. De Long, Syracuse, acted as toastmaster, calling for impromptu speeches from Messrs. J. R. Lovejoy, Edward F. Peck, W. J. Clark and Frank H. Gale, of the General Electric Company; Mr. J. O. Carr, public service commissioner; Mr. Hugh M. Wilson, of the McGraw Publishing Company, and Mr. T. R. Beal, of the Central Hudson Gas & Electric Company, Newburgh, N. Y.

Commissioner Carr on Relations with Public and Employees

Harmonious relations with the public constitute a public-service company's greatest asset, declared Mr. James O. Carr in his address on "Public Policy." The entire life of the industry indeed depends on such relation. Since the early development period relations with the public have been improved chiefly through the serious efforts of central-station companies to co-operate with regulating bodies. The public must be educated by the public service companies, and it should furthermore be given what it is justly entitled to receive. For the company which has to struggle to exist, a serious problem is involved in determining how far to extend its service and what the character of that service should be. While he had not made up his mind definitely on this subject, Mr. Carr expressed the opinion that—since central-station companies exist through the patronage of the public—the public should primarily be given the service it is entitled to receive, regardless of the rate of return earned by the company on its investment. In this connection the speaker said that rates often depend on local conditions, therefore public service companies should not be asked to give certain rates just because they prevail in other towns of the same size.

Next to inspiring the confidence of the public, one of the greatest things a public service company can do is to cultivate, in a manly way, the regulating bodies with which it has to deal. Mr. Carr declared that it has always been his plea that men be appointed on these regulating bodies who are fully acquainted with the work they are required to handle.

Profit-Sharing with Employees

Reverting to the organization of public-service companies, Mr. Carr said: "Employees are entitled to the best you can give them. The time is coming when the man who works for you will share your profits." Qualifying this statement, the speaker said that the employee will participate in the profits left after the stockholders have received a fair return on their investment. Of course, the amount which can be distributed in this way will be limited by the revenue which the companies will be allowed to earn; but Mr. Carr expressed the belief that it is possible, when the principle of profit-sharing is recognized, that commissions will allow larger rates of income than are now permitted. In support of profit-sharing the speaker also prophesied that labor disputes would be minimized when such a practice is established. In closing, Mr. Carr called attention to other methods of securing the good will of employees, and emphasized the importance of recognizing their worth and of promoting them when opportunity offered.

Following the address, subjects relating to public policy were discussed by Messrs. E. H. Palmer of Geneva, J. C. De Long of Syracuse, Leon H. Scherck of Poughkeepsie, H. W. Peck of Schenectady, J. T. Hutchings of Rochester, and J. Edward Kearns of Schenectady.

Hydroelectric Development

Some of the subjects which should be considered in developing water-power were pointed out in a paper presented by Mr. Henry Flood, Jr., of Poughkeepsie. Where the fluctuation in stream flow is large, it is very important that a reservoir be provided to store the water so that it can be used as desired. Care must be taken not to develop storage beyond the point where it can be replaced at less expense by auxiliary plants. Where possible, forebays should be designed to compensate for daily fluctuations in stream flow, otherwise canals, flumes and pipe lines will have to carry the peak flow of water instead of the average. Waterwheels and generators should be selected to operate efficiently throughout the range of head which will be obtained, as this will be found even more important than the maximum efficiency. Daily records of head and water rate are of extreme value.

Possibilities of service interruption on transmission lines can be minimized by installing duplicate lines, loop systems and simple switching equipment. Attention was called to the fact that outdoor-type substations rated as high as 20,000 kw have been operated satisfactorily. Such substations cost from 15 to 20 per cent less than the indoor type. Reverse-power relays with definite time limit furnish fairly reliable means for selective operation between generating plants and substations, while synchronous motors will provide means for improving voltage regulation.

When to Sacrifice Economy for Low First Cost

When auxiliary steam stations are employed to compensate for water deficiency, they are usually required to operate only a short time each year. Therefore it is advisable to construct them at a low first cost, even at a sacrifice in economy. On the other hand, when auxiliary stations are operated as peak-load stations or to prevent interruptions to service the operating expenses bear a large ratio to the fixed charges, so that first cost and economy of operation must be balanced.

To cut down the cost of banking fires and maintaining boilers continuously under steam, oil and powdered fuel have been employed in furnaces in conjunction with heat-storage systems. Plants of this type have been placed in operation in less than three minutes. This is not difficult in turbine-driven generator stations where the machines are allowed to run as synchronous motors when not delivering energy to the line.

Another scheme of reducing the standby expense is to employ heat storage in conjunction with chain grates on which the fuel is laid with oil-soaked rags so fires may be started readily. The saving in fuel with this arrangement as compared with using long-banked furnaces may be as much as 117.5 lb. per boiler-hour. If the water is maintained at 200 deg. Fahr., full pressure may be raised in fifteen minutes.

Proximity and Size of Market Determine Value of Plant

The value of a hydroelectric plant depends on the size of the market available for selling energy, the proximity of this market, and the initial cost of constructing the plant. To market the output of a water-power plant rates must be offered which will interest two classes of possible consumers—those who contemplate installing their own generating equipment and those operating isolated plants. The first type can usually be attracted by offering a rate slightly below that at which electricity can be produced with coal. In selling to owners of isolated plants, however, sufficient inducements must be offered for scrapping their old equipment.

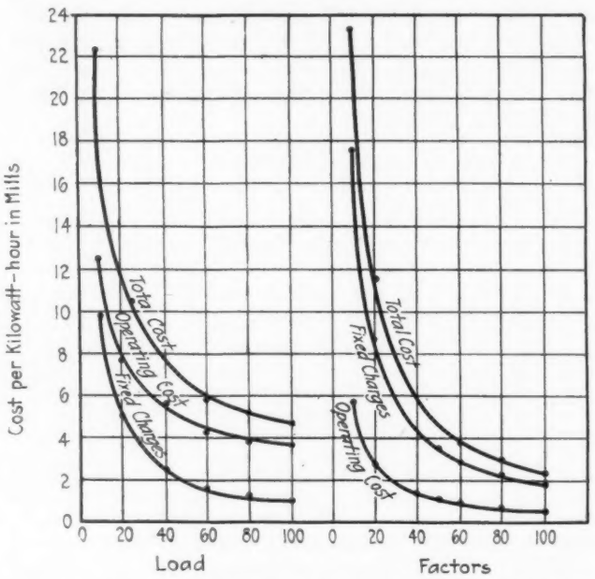
The cost of erecting and operating steam plants has been reduced considerably in the past decade owing to the advent of steam turbines, labor-saving devices and methods of operating boilers efficiently, but not so with hydroelectric equipment. Thus the costs of producing energy by steam and water-power have been converging. Furthermore, steam stations are usually near the load center, while hydroelectric stations are farther away, so that expensive transmission lines and substations must be employed. Still another factor has to be considered in marketing hydroelectric power, and that is that central stations must be displaced, or must be sold to, or must be competed with, or else an entirely new market must be developed. As it has been quite generally conceded that the central-station industry is a regulated monopoly, hydroelectric plants must of necessity sell to the central stations, which in turn derive their profit from retailing the product.

As the principal expense of producing hydroelectric energy is the fixed charge on the plant, it is essential for conducting a profitable business to have a high load-factor. To show the costs of furnishing power to the same locality from a steam station and a hydroelectric station of equivalent rating and at different load-factor, hypothetical cases have been assumed and the results plotted in the accompanying curves. These have been based on each plant having a firm rating of 6000 kw. The first costs are estimated at $140 per kw for the hydroelectric station and necessary transmission lines and $71.50 for the steam station; fixed charges are taken as 11 per cent and 12 per cent respectively; operating expenses, including repairs, are based on $5 per kw and $5.65 per kw for the hydroelectric and steam plants respectively, and fuel is assumed to cost $2.30 a ton delivered.

When Hydroelectric Development Is Profitable

The curves show that at load-factors less than 20 per cent the steam-plant costs are less than the hydroelectric. If the product is sold to central stations, there must be added to its cost, in making the selling price, the profit that a central station would demand to become interested enough to shut down its plant or operate it as a relay station. When these factors are considered, hydroelectric and steam-generated power costs are equivalent at about 30 per cent load-factor. This means that a hydroelectric plant in order to develop its market profitably must have a load-factor greater than 30 per cent. From investigations of actual conditions it was found that the average load-factor was 21.8 per cent.

In concluding, Mr. Flood said that many reports made on hydroelectric developments have been based on outputs which could be obtained only with very high load-factors. As these are not often obtained, erroneous



FIGS. 2 AND 3—RELATION OF PLANT COSTS—STEAM AND HYDROELECTRIC

conclusions may be drawn in arriving at the value of a project unless local conditions are closely studied.

Discussion

Mr. F. J. Howes, Rochester, emphasized the value of having a high over-all plant-operating efficiency rather than a high maximum efficiency. He also cited a case where hydraulic head caused by pipe friction and amounting to a considerable portion of the available head had been lost by allowing whirls in the forebay to be conveyed through the penstocks. The speaker showed that pipe friction is extremely important in low-head plants, and could have been prevented in this case by so arranging the entrance to the pipes that the water would enter correctly.

Mr. J. C. Hemingway, Glens Falls, pointed out that conditions in New York State, with the exception of those at Niagara Falls, are such that reserve stations must be used in conjunction with hydroelectric plants. He suggested designing forebays to store one day's run of water so that the hydroelectric equipment can be employed to carry peak loads while a steam reserve plant is allowed to carry the base load running at 80 per cent load-factor all of the time. It was also suggested that operating costs should not be estimated from the

performances of old hydroelectric plants as these are usually improperly equipped and in many cases not designed for the market available. The speaker expressed the belief that it does not matter so much whether interconnected hydroelectric and steam plants are owned by the same or by separate companies, but there should be the closest co-operation.

Mr. J. C. De Long was of the opinion that a steam plant can generate energy cheaper than it can purchase it from a hydroelectric plant. When both types of station are owned by the same company, however, hydroelectric power may be valuable if developed rationally.

Mr. H. M. Beugler, Poughkeepsie, expressed the belief that the best results can be obtained with hydroelectric plants when used as secondary power producers. Water available during spring freshets cannot be utilized except at an expense which will cover the cost of maintaining reliable steam generating reserve.

Dr. David B. Rushmore, Schenectady, declared that a large proportion of available water-power cannot be developed because it will not pay. As the demands for power are seasonal, just as is the amount of power available for hydroelectric development, reserve firm generating equipment or water storage must be provided since the peaks of demand and water flow usually occur at different seasons of the year. The speaker pointed out that the chance for improving generating equipment is growing less, therefore improvement in service should be made by preventing service interruptions, which means properly applying protective equipment to the system.

Mr. E. H. Palmer said that commercially and financially every hydroelectric plant must be considered independently, therefore general statements cannot be made on hydroelectric development.

Mr. T. R. Beal, Newburgh, pointed out that some water-powers which were valuable years ago are no longer so, for the reason that conditions have changed. Where peak loads are extreme and do not occur in the dry season, hydroelectric stations may be valuable for carrying the peak loads. Scientific rate making and the increased efficiency of lamps have reduced peaks in lighting loads. The value of water-power plants operating intermittently varies with the change in yearly load curves. The value of stable hydroelectric water-power has also a shifting value owing to the decreasing cost of steam generation.

Mr. E. J. Cheney, Albany, spoke on the public misconception regarding water-powers and the misdirected efforts spent in overdeveloping water-power where no market is available and where the flow drops greatly in the summer. He also called attention to the difficulty of predicting the flow of rivers accurately.

Mr. J. T. Hutchings recommended selling steam for heating and industrial power purposes as a means of minimizing the standby expense of reserve plants. The amount of steam sold should be about 25 per cent of that required for generating the maximum output of electrical energy. The speaker expressed the belief that hydroelectric power cannot be developed profitably unless five months' stable service can be provided each year, and unless water storage sufficient to carry two-hour peak loads is available during the remaining months. Even if the latter is physically possible, it may not be permitted by present laws, which entitle all users on a river to the natural flow of water. He also declared that hydraulic power is worth less now because steam-generated energy can be developed so inexpensively. With hydraulic heads of 40 ft. or more, and provided that a hydraulic site is already owned, a company can now afford to overdevelop a hydroelectric plant more than formerly as the corresponding increase in steam-generating reserve equipment which would be required is less expensive. The speaker advised companies contemplating operating in small communities to investigate the possibility of hydroelectric development, as small steam stations are expensive.

Mr. J. C. De Long emphasized the uncertainty of predicting stream flow even when long-period records are available. He also referred to a case where hydroelectric equipment was installed and not even the minimum power developed could be sold. Another instance was cited where power could be generated with steam more cheaply than it could be purchased from the Niagara Falls company. The speaker said that too many persons are over-enthusiastic regarding hydroelectric development, and that it is too expensive when supplemented by a reserve station. When a hydroelectric and a steam station are owned by the same company, however, hydroelectric generation may be valuable as a peak-load carrier.

Mr. Beugler emphasized the importance of investigating conditions thoroughly before developing any plant. He expressed the belief that companies are not restricted to selling steam to reduce standby expenses, as this can be done by securing a contract for supplying a small amount of electrical energy.

Mr. I. Lundgaard, Rochester, called attention to the high tax placed on water sources, and said this impost limits conservation of energy.

Mr. R. E. Argersinger, Schenectady, declared that preliminary investigations are the secret of successful hydroelectric development. He called attention to the high value of hydroelectric power where coal is abnormally expensive. Induction generators driven by waterwheels, the speaker declared, are not so simple to operate as many persons believe, and should not be left attendantless under any condition. These machines may even reduce the rating of other equipment connected therewith because of their power-factor. In closing, he said that frequencies ought to be standardized so that hydroelectric systems can be interconnected to take advantage of diversified loads and stream flows.

Value of Bureau of Standards to Industrial Concerns

In preparing specifications for government purchases the division of engineering research of the Bureau of Standards, Washington, D. C., is collecting considerable data on the components which should be included in different products to give the most desirable qualities. This information is open to any persons or companies who may apply for it, according to remarks made by Dr. W. S. Stratton, director of the Bureau of Standards. As most scientific standards are unusable in their original form, one of the largest tasks is to make them available for public use. Dr. Stratton declared that the greatest fault which has existed in making government purchases in the past has been the lack of knowledge regarding the constituents of materials desired. Conditions have been bettered recently, however, by making use of data which the bureau has collected by manufacturing articles in a small way and testing them to find the effect of different constituents. The speaker declared the bureau feels well repaid for its investigations, because manufacturers and purchasers who have applied for the information so obtained have realized, probably for the first time, the value of research work to all industries. Satisfaction has also been obtained by finding that many materials which are at present imported can be made equally well in this country if advantage be taken of the bureau's research work. Especially is this true in the porcelain industry. Purchasing by specifications has also taught manufacturers to be more careful in their operations.

An account of the discussion on commercial subjects will appear in a later issue of the ELECTRICAL WORLD.

Miscellaneous News Notes

Panama Canal Applies for N. E. L. A. Membership.—Col. George W. Goethals, Governor of the Panama Canal, has applied to the National Electric Light Association for membership. The Panama Canal electrical development is an important feature of the canal operations.

Purdue Electrical Students on Inspection Trip.—Approximately fifty students from Purdue University, Lafayette, Ind., in charge of Profs. C. Francis Harding, A. N. Topping and D. D. Ewing, visited points of electrical interest at St. Louis and Keokuk on a three-day inspection trip which ended May 1.

Gas-Filled Tungsten Lamps Withstand Explosion.—An explosion in a Middleport (N. Y.) factory not long ago broke every window in the building, blew the doors completely off their hinges, raised the roof 18 in., broke the anchor bolts, and bent the truss rods, yet the 200-watt gas-filled tungsten lamps with which the factory was equipped were apparently in no way injured.

Sanitary District Consulting Engineer to Remain.—Mr. Lyman E. Cooley, consulting engineer for the Sanitary District of Chicago, whose dismissal by the board was announced in the ELECTRICAL WORLD of May 1, is now to retain his office. The action of the board in dismissing Mr. Cooley was taken in the absence of the board's president, Mr. T. A. Smyth. On his return Mr. Smyth vetoed the board ruling, and the members of the board were unable to obtain a majority to override the president's veto.

Change to Gas-Filled Lamps Will Pay Own Construction Costs.—By equipping its street-lighting system with thirty-three nitrogen-filled lamps the Town Board of Ripley, Ky., has so reduced the load on its generating-plant equipment that it now offers for sale, without increasing its equipment rating, power enough to serve 400 incandescent lamps. The change was made to the nitrogen-filled lamps after careful experiments, and the board hopes to realize from the sale of energy enough to meet the cost of the change.

A Rain Alarm for Open Windows.—Fresh-air sleepers whose slumbers by wide-open windows have hitherto been marred by fears of rain pelting into the room during the night and damaging furniture and wallpaper can now procure an automatic alarm which will arouse them in case of a sudden shower. A rain-collector disk is placed on the sill of the window to be guarded, and if during the night rain is blown into the room, the first drops to fall close a circuit setting off an alarm and lighting a miniature lamp which indicates at once the window needing attention.

Berlin Electric Works Purchased.—The city of Berlin, Germany, is reported to have purchased the private electric light and power plants for $32,000,000. The system has developed from a very small beginning, inaugurated by the German General Electric Company. The service began in 1885 with 3000 incandescent lamps on the company's lines, and increased until in June, 1914, 2,107,000 incandescent lamps, 44,200 arc lamps, 43,000 electric motors and 7850 other electric appliances were connected. The output of the plants in 1885 was 37,000 kw-hr.; in 1914 it was 267,600,000 kw-hr.

New Office Building for Pacific Gas & Electric.—Work has been commenced by the Pacific Gas & Electric Company on a modern eight-story office building at the corner of Sutter and Powell Streets, San Francisco. The new structure, which is to cost about $150,000, will be connected to the building on adjoining property, which is now occupied by the power company, and will be used by the Pacific company's organization exclusively. Expansion of business and a desire to concentrate the staff of the company are the reasons given by Mr. John A. Britton, vice-president and general manager, for erecting the new structure.

X-Ray Saves Thousands for Tobacco Industry.—A small insect commonly known as the "tobacco bug" annually destroys thousands of dollars' worth of tobacco. Large sums of money have been expended in fighting the pest. Electrical sterilization of the eggs of the bettle with a high-frequency current has proved ineffectual because the current follows the lines of moisture and leaves the eggs in the dry places practically unscathed and in a condition to become destructive later. A special X-ray machine, constructed by Mr. Franklin Smith, of Philadelphia, is said to have shown itself to be thoroughly effectual in sterilizing the beetles' eggs. At the Cuesta Rey Company's factory at Tampa, Fla., about 800 cigars are treated by X-rays every minute.

Legislation in Ohio.—The Myers bill, containing provisions that would place municipal public utilities upon the same operating basis as privately owned plants, was defeated in the Ohio Senate on April 4 by a vote of 20 to 9. It would have required plants to earn 5 per cent in addition to interest and sinking funds, after deducting the cost of operation, before they could sell their output outside of the municipal boundaries. On the same day the Senate reconsidered the Horn bill, passed previously, and it will be called for a vote later. The bill sought to repeal the law which provides that villages and towns must condemn and acquire privately owned plants before municipal plants may be built. It had particular relation to the new municipal plant at Orrville, which can not be put into operation, as it is involved in litigation on this point.

Associations and Societies

American Association of Refrigeration.—At the fifth annual convention of the American Association of Refrigeration, held in the Hotel Astor, New York, May 11 and 12, the sessions were largely taken up with committee reports on the technical, business and financial aspects of refrigeration and ice-making. All of the officers, headed by Mr. Frank A. Horne, New York, president, were re-elected for the ensuing year.

Philadelphia N. E. L. A. Section.—Mr. A. A. Boyle spoke on the subject "The Work of the Commercial Inspection Department of the Philadelphia Electric Company" before the April 27 meeting of the commercial branch of the Philadelphia Electric Company Section, National Electric Light Association. The speaker particularly emphasized the value of such inspection in rendering proper service to customers and in the adjustment of complaints.

Institute of Radio Engineers.—At the May meeting of the Institute of Radio Engineers, held at Columbia University, Mr. Benjamin Liebowitz presented a paper on "The Pupin Theory of Asymmetrical Rotors in Unidirectional Fields." The paper dealt first with a simple circuit having no resistance and with a periodically varied inductance, showing in a simple manner that an infinite number of harmonies are generated therein. Leading on to the Pupin theory of two circuits, one of which is radiated in the field of the other and upon which a constant voltage is impressed, it was shown that the general theory may be simplified to an extent where it becomes analogous to the first case. The explanation of Dr. Pupin's theory to the case, including condensers, was then taken up and a general application to the theory of the Goldschmidt radio-frequency alternator was made.

Ohio Central-Station Salesmen to Meet at Columbus.—The program for the convention of the committee on new-business co-operation of the Ohio Electric Light Association, which is to be held at the Virginia Hotel, Columbus, Ohio, May 19, has been announced as follows: Address of welcome by Mr. S. G. McMeen, president of the Columbus (Ohio) Railway, Power & Light Company; "Value of Show-Window Advertising," by Mr. L. T. Milnor, district manager of the Western Electric Company at Cincinnati: "Service First," by Mr. A. C. Seymour, president of the Columbus Chamber of Commerce; "Possibilities of Industrial Electric Heating from a Central-Station Viewpoint," by Mr. H. O. Loebelle, industrial heating expert for Henry L. Doherty & Company, New York City, and "Electrical Advertising," by Mr. V. L. Blanchard, of the Toledo Railways & Light Company. This meeting, the fifth to be held since the 1914 annual convention of the Ohio Electric Light Association at Cedar Point, is the last of a series of successful sales-committee meetings. In issuing the program Mr. Thomas F. Kelly, of Dayton, chairman, has cordially invited central-station men of Ohio and neighboring states to be present.

Pittsburgh Section, A. I. E. E.—The Pittsburgh (Pa.) Section of the American Institute of Electrical Engineers on May 8 made an inspection trip to the Brunots Island power plant of the Duquesne Light Company, Pittsburgh, Pa. Mr. R. S. Orr, general manager of the company, was in charge of the trip.

I. E. S. Chicago Director.—Among the list of nominees for officers of the Illuminating Engineering Society published on page 1160 of the ELECTRICAL WORLD, dated May 8, appeared the name of Mr. W. A. Durgin, Pittsburgh. The address given is incorrect. Mr. Durgin is testing engineer with the Commonwealth Edison Company, Chicago.

The Watt-Hour Club, Long Island City, N. Y.—Employees of the New York & Queens Electric Light & Power Company have formed the Watt-Hour Club. Mr. Frank E. Andrews, of Flushing, N. Y., is president, and Mr. E. J. Murphy is secretary-treasurer. The executive committee consists of Messrs. William Banger, Walter Des Rault, H. J. Hoffman, M. J. Roth, C. B. Stecker and C. E. Hickey. At the organization meeting of the club Mr. C. A. Barton, general sales agent, addressed the members on the subject of co-operation between contractors and company.

Commonwealth Edison Section, N. E. L. A.—At a meeting of the Commonwealth Edison Company's section of the National Electric Light Association at Chicago, May 4, the following delegates and alternates were chosen to attend the National Electric Light Association convention at San Francisco: Delegates, Messrs. Guy W. Lunn, J. T. Mountain, J. L. Holman, William Barenz and John N. Walton; alternates, Messrs. George B. Johnson and Harry Strom. Mr. George B. Foster, assistant to the president of the Commonwealth Edison Company, will also attend the convention in his official capacity as president of the local section.

New York Electrical Society.—On Wednesday evening, May 19, the New York Electrical Society will hold a smoker meeting in the Engineering Societies Building. Mr. J. M. Wakeman, general manager of the Society of Electrical Development, will deliver an address on "Electrical Prosperity Week." Mr. H. W. Alexander, director of publicity for that society, will supplement Mr. Wakeman's address with a brief illustrated lecture, showing in picture form the tentative plans for the week and what is expected to be accomplished. Motion pictures relating to the advantages of utilizing electricity in the home and on the farm will also be shown.

Annual Dinner of Century Engineering Club.—More than 150 were present at the annual dinner and smoker of the Century Engineering Club, an organization of employees of the Century Electric Company, St. Louis, Mo., which was held in the banquet room of the American Annex Jovian Hotel on May 4. The officers and directors of the company were guests of honor. Mr. E. S. Pillsbury, president of the company, addressed the club on "Employees as Stockholders." One-third of the employees are stockholders. Mr. R. J. Russell, secretary and sales manager, spoke on the sale of the products of the company in the United States and foreign fields. Toasts were given by the other officers and directors. An elaborate vaudeville and musical program was furnished by the members of the club. During the last year the organization has directed its efforts along educational and co-operative lines. The officers of the club are: Mr. J. M. Chandlee, president; Mr. E. A. Ross, secretary; Mr. J. L. Woodress, chairman of the program committee, and Mr. A. J. Kramer, chairman of the entertainment committee.

Lehigh Valley Light & Power Company Section April Meeting.—Mr. W. K. Buckingham, electrical inspector of the Underwriters' Association for the Lehigh Valley district of Pennsylvania, made the principal address at the April meeting of the Lehigh Valley Light & Power Company Section of the National Electric Light Association, held in the Fairview Auditorium at Allentown, Pa. Chairman Irving Samuels introduced Mr. Buckingham as a post-graduate of the school of experience. The speaker gave a concise exposition of the principles and objects of the work of the Underwriters' Association. The various systems and methods adopted for the efficient handling of the large number of inspections was explained and conclusions were drawn showing the justification of the work from the widely divergent viewpoints of the consumer, the central station and the insurance company. Mr. R. C. Dornblaser, chairman of the question-box committee, presented a report on many queries relating to the subject of the Underwriters' rules and inspections. A discussion followed by Messrs. Buckingham, T. T. Fogel, A. P. Schneider and others.

Industrial Electric Heating Association Organized.—The Industrial Electric Heating Association, plans for the formation of which were noted in our issue of April 3, was finally organized at a meeting of central-station heating men and manufacturers' representatives held at Toledo, Ohio, May 1. Most of the time of the inaugural session was taken up in perfecting an organization for the exchange of data on electric industrial heating. In the afternoon the delegates visited the factory of the Willys-Overland Company and inspected the electric furnaces and electric enameling ovens used there in automobile manufacture. The officers of the new association are: President, Mr. A. K. Young, Toledo Railways & Light Company; secretary, Mr. Homer Kunz, Toledo Railways & Light Company; executive committee—Mr. H. O. Loebell, of Henry L. Doherty & Company, New York; Prof. C. F. Hirschfeld, of the Edison Illuminating Company of Detroit; Mr. J. A. Seede, of the General Electric Company; Mr. F. K. Thornton, of the Westinghouse Electric & Manufacturing Company, and Mr. M. Turner, of the Cleveland Electric Illuminating Company.

Program of Galveston Convention.—The annual convention of the Southwestern Electrical & Gas Association will be held at the Hotel Galvez, Galveston, Tex., May 19 to 22. In addition to the general sessions, special parallel meetings will be held by the electric railway men, central-station operators, gas members, and accountants. Among the papers to be presented are the following: "Important Factors in Accident Prevention," Mr. Charles B. Scott, Bureau of Safety, Chicago; "Interesting Points in Track Work and Paving," Mr. B. R. Brown; "Economies in Repair-Shop Work and Maintenance," Mr. V. W. Berry; "The Present Gas Situation in Texas," Mr. F. M. Lege, Jr.; "A New Type of Street Car for City Operation," Mr. C. O. Birney; "A Study of the 'Jitney'," Mr. R. T. Sullivan; "The Commercialization of Central-Station Organizations," Mr. Hartwell Jalonick; "What the Southwestern Electrical and Gas Association Can Do for Me," Mr. A. V. Wainwright; "The Advertising Influence of the Employee," Mr. F. R. Slater; "Welfare Work and Education of the Employee," Mr. Richard Merriwether; "Modern Electrical Commercial Distribution," Mr. Martin J. Wolf; "Positive and Negative Elements in Trade," Mr. Fred Johnson. Friday, May 21, has been designated as Jovian Day and will be brought to a close with a big rejuvenation in the evening. Mr. H. S. Cooper, Slaughter Building, Dallas, Tex., is secretary of the Southwestern association.

Arkansas Utility Operators at Little Rock.—The convention of the Arkansas Association of Public Utility Operators at Little Rock, Ark., May 11 to 13, was to open on Tuesday afternoon with an address of welcome by Mayor Charles E. Taylor of Little Rock, to which President C. J. Griffith was to respond for the association. "Financing, Constructing and Operating Public Utilities in Small Towns" was to be the subject of a paper by Mr. H. C. Couch, president Arkansas Power Company. On Wednesday the following were to be read: "Why Central-Station Operators Are Interested in and Must Control Types of Motors and Their Accessories, Starters, Controllers, Etc.," by Mr. Fred Johnson, Wagner Electric Company, St. Louis, Mo.; "Installation, Maintenance and Operation of a Modern White Way," Mr. S. E. Dillon, Citizens' Electric Company, Hot Springs; "Depreciation and Obsolescence of Public Utility Properties," Mr. J. F. Christy, Jonesboro Water & Light Company, Jonesboro, and "Application of Motors," Mr. J. J. Dorney, Westinghouse Electric & Manufacturing Company, St. Louis. Thursday's papers included "Voltage Regulation," by Mr. H. F. McRell, General Electric Company, St. Louis, Mo.; "Switchboard Cost per Kilowatt-Hour in the Small Modern Plant," Mr. Andrew Patterson, general superintendent Southwestern Gas & Electric Company, Texarkana, Ark., and "Water-Power Development and Transmission," Mr. A. E. Main, electrical engineer Mammoth Spring Electric Light & Power Company, Mammoth Spring, Ark. The convention banquet was held on Wednesday evening.

Public Service Commission News

Indiana Commission

Governor Ralston has failed so far to announce the reappointment of Messrs. Charles J. Murphy, of Brookston, and Charles A. Edwards, of Huntington, as members of the commission, although their terms expired on May 1. The Governor said, following the expiration of the terms, that he was "not ready to take up that matter yet."

District of Columbia Commission

The commission on its own initiative investigated the practices adopted by utilities for protection against loss due to non-payment of bills by customers. It was found that all utilities requiring deposits did not pay the same rate of interest thereon, in one case 5 per cent being paid, in another case 4 per cent, and in still another no interest being paid. The commission is of the opinion that, since these deposits are available by utilities for use in the transaction of their affairs, the customers are entitled to a reasonable rate of return thereon and the commission orders that 5 per cent be paid.

Missouri Commission

The decision of the commission in the case affecting the Kirksville Light, Power & Ice Company holds:

"Although a six months' test discloses that rates formerly prescribed by this commission are reasonable under economical management, yet on account of increased operating expenses the rate schedule is readjusted to allow a somewhat larger margin and rates in substance as follows are prescribed: For residence lighting: First 20 kw-hr. used per month, 11 cents per kw-hr.; next 20 kw-hr., 7 cents per kw-hr.; all in excess of 40-kw-hr., 4 cents per kw-hr. Other than residence lighting: 10 cents per kw-hr. for first 30 hours' use per month of maximum demand, 7 cents per kw-hr. for next 30 hours, and 4 cents per kw-hr. for all in excess of 60 hours."

The economical management of a public service corporation, especially as regards the possible saving to be effected by the use of the cheapest grade of coal consistent with efficient service, is also discussed. The commission says that electrical energy furnished to interrelated corporations by public service corporations should be metered and charges exacted therefor at the regular schedule of rates.

Ohio Commission

The appraisal of the electrical property of the Union Gas & Electric Company of Cincinnati was filed with the commission on May 4 by President W. W. Freeman. The company says that the figures represent the reasonable, just and lawful value of the property for rate-making purposes. The valuation was made by the engineers and experts of the company at the instance of the commission for the purpose of fixing new rates for service, which the Cincinnati Council desires. The work on the appraisal has been in progress almost a year and has been checked by representatives of the commission. The summary of the appraisal is shown in the accompanying table:

Reproduction cost, inside city	$10,562,419	
Reproduction cost, outside city	124,525	
Reproduction cost, total		$10,686,944
Accrued depreciation, inside city	$703,169	
Accrued depreciation, outside city	9,574	
Accrued depreciation, total		712,743
Present value of company's physical property used and useful in electric service		$9,974,201
Working capital		226,852
Cost of developing the business		2,716,765
Cost of financing		2,550,263
Value of franchises		5,581,600
Total value for rate-making		$21,049,681

The field sheets representing the detailed inventory number 10,000 and are 8½ in. by 11 in. in size. The appraisal records consist of four volumes, three of which cover the unit cost data on all items of physical property. These three volumes contain 840 pages 8½ in. by 11 in. in size. The fourth volume, containing a summary of the inventory, contains 170 pages 10½ in. by 14½ in. in size.

Personal

Mr. Harvey Shields is the new electrical superintendent of the Fresno (Cal.) district of the San Joaquin Light & Power Corporation, succeeding Mr. S. W. Dietrich, who resigned.

Mr. Neilson Edwards has withdrawn from the Butler-Edwards Electric Company, of Easton, Pa., to become vice-president of the Nitrogenous Chemical Company of Philadelphia.

Mr. Charles S. Evans has succeeded Mr. J. W. Kephart as president of the Ebensburg Light, Heat & Power Company, of Ebensburg, Pa. Mr. Evans was formerly vice-president of the company.

Mr. A. L. Kenyon has been appointed manager of the Anniston Electric & Gas Company, Anniston, Ala. Mr. Kenyon succeeds Mr. W. R. Hall, who was formerly manager and contract agent at Anniston.

Mr. James E. Logan, city electrician of Bangor, Maine, has been presented with a handsome gold badge as a token of regard by members of the city electrical department, with which he has been associated for the last six years.

Mr. Horace E. Andrews, president of the Rochester (N. Y.) Railway & Light Company and the Mohawk Valley Company, has been elected a director of the Michigan Central Railroad and also of the New York, Chicago & St. Louis Railroad.

Mr. Arthur Wright, of London, consulting engineer and originator of the Wright demand system, has been retained by the Edison Electric Illuminating Company of Boston, Mass., in an advisory capacity. He arrived in Boston last month to assume his new duties.

Mr. Edward N. Hurley, who was recently appointed vice-chairman of the Federal Trade Commission, has resigned as president of the Illinois Manufacturers' Association, Chicago, and Mr. Samuel M. Hastings has been chosen as his successor. Mr. Hastings is president of the Computing Scale Company of America.

Mr. O. H. Hutchings has been appointed associate general manager and engineer of the Dayton Power & Light Company by the latter's board of directors, following the departure for New York of Mr. F. M. Tait, who will retain the title of president and general manager. Mr. Hutchings has for a number of years been general superintendent and engineer of the Dayton company.

Gen. George H. Harries, who, in addition to being president of both the Louisville Gas & Electric Company and the Omaha (Neb.) Electric Light & Power Company, has been brigadier-general of the National Guard of the District of Columbia, has resigned his commission in the latter organization because of enforced absence from Washington in connection with his duties at Louisville, Chicago and Omaha.

Mr. Edwin M. Collis, of the treasury department of the Commonwealth Edison Company, Chicago, was one of the survivors of the *Lusitania* catastrophe, he having been on his way to London to collect a legacy of appreciable size left to him and his sister by his brother. Mr. Collis has been in the employ of the Commonwealth Edison Company for sixteen years. Cable dispatches from Queenstown state that Mr. Collis was saved by clinging for two hours to a piece of wreckage after jumping from the sinking liner with a life belt about him.

Mr. Charles F. Wallace, of the Stone & Webster Management Association, Boston, Mass., is to represent the Stone & Webster interests in the Southwest in an executive capacity, with headquarters at Dallas, Tex. Mr. Wallace is a native of California, and was graduated from the Massachusetts Institute of Technology in the electrical engineering course about twenty-three years ago. He immediately became associated with Stone & Webster, and was appointed head of the enginering department within a few years. Mr. Wallace has also had important managerial work in connection with the firm's properties, with broad executive duties in connection with various Southern utilities and hydroelectric developments, including the Mississippi River Power Company.

Obituary

Woodbury E. Corson, city electrician of Haverhill, Mass., died at his home in Haverhill on May 6. Mr. Corson was chief engineer of the Haverhill Electric Company before his appointment as city electrician ten years ago.

Walter L. Sawtelle, manager of the lighting department of the Bangor (Maine) Railway & Electric Company, died at his home at Bangor, May 4, at the age of thirty-eight. Mr. Sawtelle was a native of Boston and was formerly in the employ of the Old Colony Railroad Company, later joining the staff of the Lewiston, Augusta & Waterville Street Railway. Mrs. Sawtelle is the daughter of Mr. John R. Graham, president of the Bangor company.

Dr. Fred Stark Pearson, who lost his life when the steamship *Lusitania* was sunk by a German submarine on May 7, was born and educated in this country and developed from here the beginnings of his large engineering business, which came to be international in scope. Although he still kept a home at Great Barrington, Mass., where he had an estate of 12,000 acres, much of his time for the last few years had been spent in England, where he had homes in Surrey and in London. It was necessary for him to be in England a great deal because of the large English interest in properties with which he was connected in Mexico, South America and Spain. Until Dr. Pearson arrived here in April he had not been in this country for two years. One of the objects of his trip was to consider plans for the Denver & Salt Lake Railroad, of which he was chairman of the board of directors. The improvements contemplated for that property include electrification, or the construction of an extensive tunnel or a combination of inclined railroads and tunnels for use during the next few years until easier money conditions permit the electrification which is desired eventually. Dr. Pearson was returning to Europe to meet security holders of the Barcelona Traction Light & Power Company, Ltd., and make final arrangements to continue construction. This company has completed one of its large power plants and the transmission lines which are in partial operation. It has constructed canals, dams and other hydraulic works, and the future developments outlined are to reach as large a total as the combined output of the plants at Niagara. Dr. Pearson was born at Lowell, Mass., on July 3, 1861. He was graduated from Tufts College. In 1879 and 1880 he was instructor of chemistry at the Massachusetts Institute of Technology. From 1883 to 1886 he was instructor in mathematics and applied mechanics at Tufts. For the following two years he was a mining engineer, operating in the United States and Brazil. In 1888 he was manager of the Somerville (Mass.) Electric Light Company and later served successively as chief engineer of the West End Street Railway of Boston, the Dominion Coal Company and the Metropolitan Street Railway of New York. During his service with the last-named company he constructed the underground conduit system. The wide extent of Dr. Pearson's later enterprises is shown by the fact that he was president and a director of the Mexico Tramways Company, the Mexican Light & Power Company, Ltd., the Mexico Northwestern Railway Company, the Rio de Janeiro Tramway, Light & Power Company, and the Barcelona Traction, Light & Power Company, Ltd. He was also a director of the Sao Paulo Tramway, Light & Power Company. Dr. Pearson was a member of the Institution of Civil Engineers of London, the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Association for the Advancement of Science, and the Society of Naval Engineers. He was a member of the following clubs in New York: University, Engineers', New York Yacht, and Railroad.

F. S. PEARSON

Corporate and Financial

American Public Utilities Company, Grand Rapids, Mich.—In a booklet describing the property, Kelsey, Brewer & Company, under whose management the company is, state that the general financial depression has served to reduce the volume of business which otherwise would have been done by public service companies, particularly those serving industrial communities. Notwithstanding this, all but two of the subsidiary companies showed substantial increases in the sale of gas and electricity in 1914 as compared with 1913, and the two decreases amounted only to 1 per cent and 7 per cent respectively. During the last six months the companies have followed a very conservative course in their efforts to obtain new business, confining sales of appliances almost exclusively to cash transactions. Results have been satisfactory. Earnings for the eight months ended March 1, 1915, follow:

Gross earnings from operations of subsidiary companies		$1,980,960
Operating expenses		1,079,992
Net earnings from operations		$900,968
Miscellaneous income		23,169
Gross income		$924,137
Less expense		27,172
Net income		$896,965
Fixed charges for eight months:		
Interest on underlying securities	$552,734	
Interest on collateral trust bonds	23,167	
Miscellaneous interest	34,805	
Total fixed charges		610,706
Remainder applicable to renewals and dividends		$286,259
Dividend on $3,914,000 preferred stock		156,560
Balance		$129,699

Baton Rouge (La.) Electric Company.—The company has sold $150,000 three-year 6 per cent gold coupon notes due on April 1, 1918. The proceeds will be applied to the purchase of land and to build a 2000-hp steam station.

Birmingham (Ala.) Railway, Light & Power Company.—An issue of $1,150,000 of 6 per cent notes is offered at 99½ and interest. The notes are dated May 1, 1915, and are due on May 1, 1917. Earnings for the telve months ended Dec. 31, 1914, follow:

Gross earnings	$3,217,826
Operating expenses and taxes	1,922,605
Net earnings	$1,295,221
*Interest on bonds outstanding	700,290
Income applicable to interest on bonds	$594,931
Annual interest on $1,150,000 notes	69,000
Surplus	$525,931

*Interest for twelve months on bonds outstanding as of date of notes.

Dayton (Ohio) Power & Light Company.—The recent report that the company would be included with the other utilities operating in Dayton in one large merger is without foundation, according to a statement of Mr. Frank M. Tait, president of the company. The company will continue, he says, to be strictly an operating company and not a holding company for securities of the other Dayton utilities.

Edison Light & Power Company, York, Pa.—The York City Council has given the company permission to absorb the Merchants' Electric Light, Heat & Power Company.

Elmira (N. Y.) Water, Light & Railroad Company.—The company has been authorized by the New York Public Service Commission, Second District, to issue $232,000 of 5 per cent fifty-year first consolidated mortgage bonds at not less than 90. The proceeds, together with $1,500,000 received from the sale to the city of the company's waterworks, will be used to retire on July 1 at 105 the $1,661,000 purchase money 5 per cent bonds due on Jan. 1, 1949.

Federal Electric Sign System, Chicago, Ill.—The company has passed its regular quarterly preferred-stock dividend of 1¾ per cent due on May 1.

Interstate Electric Company, Edinburg, Ind.—Mr. F. A. Goodin, of Edinburg, has been appointed receiver for the company, which bought the Thompson mill site, near Edinburg, in 1913, for the purpose of supplying energy to several Indiana cities and electric railways. Mr. Goodin was ordered by the Johnson County Circuit Court to sell the assets to satisfy a judgment of $6,054.

Mahoning County Light Company, Youngstown, Ohio.—The Supreme Court has sustained the company's motion to dismiss the suit of the Youngstown & Sharon Street Railway Company to enjoin the light company from issuing $400,000 stock and $530,000 bonds. The railway company contended that if the light company went ahead with the sale of its securities a duplication of service would ensue in Youngstown, thereby depreciating the railway company's holdings.

Manchester (N. H.) Traction, Light & Power Company.—The New Hampshire Public Service Commission is hearing an application for authority to issue $1,000,000 in 5 per cent three-year notes to pay for new construction.

Massachusetts Lighting Companies, Boston, Mass.—Shareholders have received notice that the Light, Heat & Power Corporation will discontinue its engineering and construction departments. This change in policy, it is stated, will have little or no effect on the net earnings and no effect on the intrinsic value of the stock, all of which is owned by the Massachusetts Lighting Companies. Since July, 1904, the Light, Heat & Power Corporation has done the engineering and construction work made necessary by the important additions and improvements to the plants and distribution systems of the gas and electric light companies whose shares are owned by the Massachusetts Lighting Companies. These larger improvements have put the plants in excellent physical condition, and they are now in a position to do their own construction work economically and furnish a greatly increased number of customers. The operating companies have made several price reductions in the last year, which, together with general business conditions, caused a decrease of less than 1 per cent in gross earnings for the eight months ended March 1, 1914. Some of the companies have already gained enough new business to make up for the reductions and the others are making rapid progress.

Minnesota Electric Light & Power Company, Duluth, Minn.—An issue of $300,000 of first mortgage 6 per cent sinking-fund gold bonds dated May 1, 1915, and due on May 1, 1935, is offered at par and interest.

Pacific Gas & Electric Company, San Francisco, Cal.—The California Railroad Commission has authorized the issue of $367,000 general and refunding mortgage gold bonds. The bonds are a portion of the $4,586,661 authorized by the commission on June 30, 1914.

Penn Central Light & Power Company, Altoona, Pa.—Dividends on the 6 per cent non-cumulative preferred stock have been resumed, the directors having declared a dividend of 1 per cent payable on April 30.

Plymouth (Mass.) Electric Light Company.—The Board of Gas and Electric Commissioners of Massachusetts has authorized the issue of $90,000 additional stock at 100 to capitalize the cost of transmission-line construction to Kingston, Marshfield, Chiltonville and to the lines of the Marion Gas Company at Carver.

San Joaquin Light & Power Corporation, Fresno, Cal.—The California Railroad Commission has made an order authorizing the corporation to issue $1,582,000 of series "C" 6 per cent forty-year first and refunding mortgage gold bonds. The company is also authorized to issue interest coupons calling for 1 per cent additional interest per annum to any holders of the $2,924,000 of series "B" bonds now outstanding who will pay a premium of $100 upon each $1,000 bond held by them. Of the new series "C" bonds which the company is authorized to issue, $1,532,000 are to be issued in lieu of a like amount of series "B" bonds now held in the company's treasury or pledged as collateral. The commission's order provides that the series "C" bonds shall be sold at such a price that the first $300,000 of bonds shall yield not less than 95 and interest. The proceeds derived by the company from the sale of the securities will be used in retiring $954,000 of two-year collateral-trust notes due Aug. 1, 1915, and in paying $838,300 outstanding notes representing funds borrowed for capital expenditures. The order is made dependent upon submission by the company within ninety days of a financial plan by means of which it may secure funds to defray the cost of necessary extensions, additions and betterments by other means than the sale of bonds.

Southeastern Ohio Railway, Light & Power Company, Zanesville, Ohio.—Upon application of a creditor, Mr. W. A. Wilson, president of the company, was appointed receiver.

Texas Power & Light Company, Dallas, Tex.—An additional issue of $140,000 of the company's first mortgage 5 per cent gold bonds is offered at 93½ and interest.

Utica (N. Y.) Gas & Electric Company.—The New York Public Service Commission, Second District, has authorized an issue of $350,000 5 per cent fifty-year refunding and extension mortgage gold bonds to be sold at not less than 95 for the payment of current obligations incurred for capital purposes and in part to take up $351,481 short-term notes. The commission does not act at this time on the petition for an issue of $2,500,000 capital stock for the reimbursement of the treasury for capital expenditures. From verified balance sheets, however, the commission is satisfied that the fixed assets have increased during the period covered in an amount in excess of what is required for the present bond issue.

Washington (D. C.) Railway & Electric Company.—The company has been authorized by the Public Utilities Commission of the District of Columbia to issue $13,500 general improvement 6 per cent debenture bonds.

Washington-Oregon Corporation, Vancouver, Wash.—The reorganization committee's plan of reorganization proposes that the property covered by the first and consolidated mortgage be purchased subject to the mortgage previously executed by the Twin City Light & Traction Company. A new company shall be formed with $1,750,000 capital stock, consisting of $1,200,000 6 per cent cumulative preferred stock and $550,000 common stock. The preferred stock should be subject to retirement by the vote of a majority of the common stock upon payment at 110 and accrued dividends. The new company shall execute a prior-lien mortgage which shall provide for a twenty-year 6 per cent bond issue not to exceed $350,000, of which $200,000 shall be issued immediately. Additional bonds may be issued to the extent of 75 per cent of the cost of betterments and extensions, provided that net earnings for the twelve months preceding shall have amounted to at least twice the interest charges on the outstanding bonds, including those to be issued. The company shall also authorize an issue of $2,500,000 of 6 per cent twenty-five-year general-lien mortgage bonds, of which $675,000 shall be issued immediately. Not exceeding $700,000 shall be used for the retirement at par of the Twin City Light & Traction Company bonds and the bonds which shall have been issued under the prior-lien mortgage. Further bonds may be issued up to 85 per cent of the cost of betterments and extensions, provided that net earnings for the twelve months preceding shall have been at least one and one-half times the interest charges on all bonds outstanding, including those to be issued. The general-lien mortgage shall further provide for the authorization of not to exceed $600,000 bonds for the reconstruction or enlargement of the hydroelectric plant near Kalama, Wash. Bonds shall not be issued for new construction or reconstruction unless there remain uncertified sufficient bonds to retire the outstanding Twin City Light & Traction Company bonds and outstanding prior bonds. Holders of the old company's first and consolidated mortgage bonds shall receive 40 per cent of the face value in the new general-lien bonds and 60 per cent in preferred stock. The common stock shall be delivered to trustees who shall apportion stock-purchase certificates among holders of the old corporation's second mortgage bonds and other junior claimants. These junior claimants holding stock purchase certificates may purchase at any time prior to April 15, 1920, the outstanding preferred stock.

Western Light & Power Company, Boulder, Col.—Holders of certificates of deposit representing preferred and common stock and first mortgage 5 per cent redeemable sinking-fund gold bonds of the Northern Colorado Power Company, the former name of the Western Light & Power Company, have been notified that on surrender of their certificates of deposit they will receive the new stock, or the certificates of interest in new bonds and the cash representing coupons due Nov. 1, 1913, on deposited bonds, to which they may be entitled.

Manufacturing and Industrial

Walker Brothers & Haviland, general sales representatives in Chicago for the Industrial Controller Company of Milwaukee, Wis., and also selling agent for the Monarch synchronized time system, have moved their offices from 955 Monadnock Block to 1821 People's Gas Building, Chicago.

The American Ever Ready Works of the National Carbon Company, Long Island City, New York, have appointed the Union Electric Company, Pittsburgh, Pa., as their agent to handle their non-sulphating storage batteries in the Pittsburgh district. A service station will be opened at 418 West Street, Pittsburgh.

Mr. E. L. Kerstetter, who was recently made manager of the pole department of the Carbo Steel Post Company, Rand-McNally Building, Chicago, Ill., has had fifteen years' experience in the electrical and manufacturing business. He was formerly connected with the Chicago Telephone Company and the Elkhart (Ind.) Manufacturing Company.

The Life-Saving Devices Company of Chicago has moved its factory and its offices from 565 Washington Boulevard to 180 North Market Street. In its new location the firm will occupy floor space about three times as large as that formerly used. Mr. Frank T. Fowler, president of the company, has stated that the change was made so that the concern might handle the large volume of government business which it is to receive.

Electrical Equipment for United States Training Ship "Dorothea."—Among the contracts recently secured by the F. M. Grant Electric Company, Cleveland, Ohio, is one for a complete galvanized-iron conduit system together with several hundred galvanized "condulet" fittings for the lighting and motor circuits on the United States training ship *Dorothea*. The ship is now equipped with wooden molding, every foot of which is to be removed.

W. M. Sheehan & Company, 114 Liberty Street, New York, electrical contractors and dealers in electrical supplies, have been reorganized. Mr. J. M. Sheehan, president and general manager of the Upper Hudson Electric & Railroad Company, will act as president, and Mr. N. W. Dalton, formerly of the Bath Electric & Gas Light Company and recently in charge of electric work for the Hartford Carpet Corporation, will act as general manager.

Magneto Manufacturer to Award Prizes for Automobile Races.—The Bosch Magneto Company, 223 West Forty-sixth Street, New York, will distribute prizes as follows for the 500-mile international sweepstakes race which will take place May 30: For cars using the Bosch magneto, winning driver $500, driver of second car $300, driver of third car $200; for cars using Bosch plugs in addition to Bosch magneto, winner $100, second $100, third $100.

Mr. H. J. Solon has been appointed district manager of the Franklin Electric Manufacturing Company for New York City, with offices at 47 West Street. For the last two years Mr. Solon has been sales manager of the Pittsburgh office of the Westinghouse Lamp Company, and prior to that time he was associated with the Macomber-Whyte Rope Company. Mr. Solon succeeds Mr. George F. Marriott as manager of the New York office of the Franklin company, the home office and factory of which are at Hartford, Conn.

Business of Boiler-Cleaner Company on Upward Trend.—The Roto Company, Hartford, Conn., manufacturer of boiler-tool cleaners, reports that its business has grown steadily through the entire period of the recent industrial depression. The company made a new high record for sales for the month of March, and there was an increase in the number of sales during April over that of March. A contract was recently closed for extensions which will more than double the floor space of the Roto Company's plant.

The Butler-Edwards Electric Company of Easton, Pa., which last year purchased the business and plant of the Edwards & Smith Company of Easton and the business and equipment of the Butler Electric Company of Chicago, has been receiving orders which tend to show gratifying general business improvement. An electric-fan concern of Newark, Ohio, has given the company an order for $12,000 worth of goods, and a dental sales company of Madison, Wis., has placed an order for $15,000 worth of dental engines. Mr. W. E. Harvey, sales manager, reports that conditions in the field in which the company does business have improved more than 100 per cent since December.

Westinghouse Company Buys Stevens Arms Plant.—Mr. L. A. Osborne, senior vice-president of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has just announced, it is reported, that negotiations have practically been completed for the purchase of the plants of the J. Stevens Arm & Tool Company at Chicopee Falls, Mass., and East Springfield, Mass. Work will be rushed, it is said, on a large order for arms from one of the belligerent countries. After the war is over the factories will be used for the manufacture of electrical products. It is announced that Mr. W. L. Clark, formerly vice-president of the Niles-Bement-Pond Company, will be made manager of the two plants.

Foreign-Trade Envoy from Illinois to Russia.—Plans for an organized campaign to obtain Russian foreign trade were completed in Chicago on May 4, at a meeting of the Illinois Manufacturers' Association, at which thirteen members agreed to send Mr. Marcus S. Hill, a foreign-trade expert, to Petrograd, to open display rooms for Illinois products and to pave the way for selling campaigns. He will leave Chicago about June 1. Nearly thirty other manufacturing concerns are expected to join the movement. Among the electrical firms interested in this work are the National Stamping Electric Works, the Kellogg Switchboard & Supply Company and the Victor Electric Company, all of Chicago, and the Schroeder Headlight Company, Evansville, Ind.

Orders for Air Washers and Spray-Cooling Equipment.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has recently received orders for air washers from the Cambridge (Mass.) Electric Light Company, the Lynn (Mass.) Gas & Electric Company, the Public Service Electric Corporation of New Jersey, the North American Chemical Company, Bay City, Mich., and the Evansville (Ind.) Public Service Company. The company has also received contracts for spray-cooling equipment from the Stone & Webster Engineering Corporation for the Remington Arms & Ammunition Company's plant at Bridgeport, Conn., the Southern Power Company at Greenville, N. C., and the Ford Motor Company, Detroit, Mich. Although during the winter the business of the Spray Engineering Company was quiet, since March 1 it is reported to have improved greatly, and at present is very good.

Orders for Gas-Engine Equipment.—The Bruce-Macbeth Engine Company, Cleveland, Ohio, has recently received the following orders: The Fedders Manufacturing Company, Buffalo, N. Y., one 100-hp natural-gas engine; the Knickerbocker Amusement Company, Detroit, Mich., one 60-hp artificial-gas engine; the Mansfield Milling Company, Mansfield, Ohio, one 350-hp natural-gas engine with auxiliary equipment for generating steam; the Galion Iron Works & Manufacturing Company, Galion, Ohio, one 150-hp natural-gas engine; the Setter Brothers Company, Cattaraugus, N. Y., one 125-hp natural-gas engine; the Brookville Glass & Tile Company, Brookville, Pa., two 90-hp natural-gas engines; the Dunn-Taft Company, Columbus, Ohio, one 15-hp natural-gas engine; the Fostoria Glass Company, Moundsville, W. Va., one 150-hp natural-gas engine, which is the fourth unit ordered by the company.

Business in Second-Hand Machinery Improving.—Edgar M. Moore & Company, Pittsburgh, Pa., dealers in new and second-hand electrical and steam machinery, report that the business of their concern in second-hand machinery during the latter part of 1914 and the first two months of this year was only fair. In November, 1914, the company disposed of one of two 750-hp gas engines which it had had on hand for a year. The other engine was sold April 1 of this year. Subsequently two 110-hp gas engines, one 1000-hp gas engine, one 85-hp gas engine, one 55-hp gas engine directly connected to a generator, two 400-hp Babcock & Wilcox boilers, one 19-in. by 14-in. air compressor, one 150-hp direct-current motor and one 100-hp direct-current motor, together with a number of small motors, gas engines, air compressors and machine tools, were sold. The large gas engines were fitted with compressors for natural-gas pumping stations.

Electric Pumps for Dry Dock in Panama Canal Zone.—The contract for a complete pumping plant for Dry Dock No. 1, Balboa Terminals, Balboa, Canal Zone, Isthmus of Panama, was recently awarded by the Panama Canal Commission to Henry R. Worthington, New York. The pumping plant comprises four main pumps, two drainage pumps and one bilge pump. Each main pumping unit consists of a 54-in. vertical-shaft, single-bottom-suction, single-impeller, volute centrifugal pump which is directly connected to a 1000-hp constant-speed alternating-current vertical motor of the squirrel-cage induction type. The drainage pumps are of the volute centrifugal type and are equipped with 20-in. vertical shafts. Each drainage pump is directly connected to a 200-hp vertical alternating-current motor. The bilge pump is of the vertical self-contained centrifugal type having a 4-in. suction and a 3-in. discharge and is directly connected to a 10-hp vertical alternating-current motor. The motor for the bilge pump is provided with both hand and automatic control. The contract also includes all the hand and electrically operated gate valves as well as the automatic check valves. For operating the gate and sluice valves by electricity, a hydraulic pressure system is provided, consisting of a weighted accumulator and the necessary pressure pumps in duplicate. The control of all electrically operated valves is from a control board to which are brought all necessary pipes and on which are placed the necessary operating valves. Three-phase, twenty-five-cycle, 2200-volt energy is utilized to operate the motors.

NEW YORK METAL MARKET PRICES

	May 4 Selling Prices Bid	May 4 Selling Prices Asked	May 11 Selling Prices Bid	May 11 Selling Prices Asked
	£ s d	£ s d	£ s d	£ s d
Copper				
London, standard spot*	76 0 0		77 12 6	
Prime Lake	18.62½ to 18.87½		18.75 to 19.00	
Electolytic	18.37½ to 18.50		18.50 to 18.75	
Casting	17.37½ to 17.50		17.50 to 17.75	
Copper wire base	20.00		24.00	
Lead	4.20		4.20	
Nickel	42.00	to 45.00	42.00 to 45.00	
Sheet zinc, f.o.b. smelter	17.50		17.50	
Spelter, spot	13.50	to 13.75†	14.00 to 14.25†	
Straits tin	39.50†		40.37½	
Aluminum, 98 to 99 per cent	19.25	to 19.50	19.50 to 19.75	

*OLD METAL

Heavy copper and wire	17.00	17.00
Brass, heavy	11.25	11.25
Brass, light	9.25	9.25
Lead, heavy	3.95	3.95
Zinc, scrap	10.50	10.50

*COPPER EXPORTS

Total tons to May 11	10,274

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Industrial Companies

The Detroit Electric Car Company, of Buffalo, N. Y., has been incorporated with a capital stock of $10,000 by Charles E. Sager, Helen Sager, of Rochester, N. Y., and George B. Pratt, of Gowanda, N. Y.

The International Battery Company, of New York, N. Y., has been incorporated by S. Fassy, S. J. and E. Grazi, 783 Prospect Avenue, the Bronx. The company proposes to manufacture and deal in electrical devices and machinery.

George K. Webster, Inc., of New York, N. Y., has been incorporated with a capital stock of $10,000 to manufacture and deal in electric-lighting supplies, fixtures, etc. The incorporators are M. Vladimir, W. and G. K. Webster, 1 State Street, New York, N. Y.

The Eugene T. Turney Company, of the Bronx, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in mechanical and electrical devices, novelties, etc. The incorporators are M. R. Musser, L. M. and E. T. Turney, 2595 Third Avenue, New York, N. Y.

The Mac Manufacturing Company, of Syracuse, N. Y., has been incorporated by B. Wiles, E. E. Tilton and F. F. MacLean, 1311 Madison Street, Syracuse, N. Y. The company is capitalized at $50,000 and proposes to do a general contracting, electrical and mechanical engineering business and to deal in autos, lamps, etc.

New Incorporations

The Parkersburg Electric Company, of Parkersburg, W. Va., has been incorporated with a capital stock of $100,000 by F. O'Connor, G. T. Partridge, John Marshall, and others.

The Shandon Lighting Company, of Shandon, Ohio, has been incorporated with a capital stock of $5,000 by J. D. Schradin and others. The company proposes to supply electricity for lamps and motors in Shandon.

The Medicine Bow Electric Company, of Medicine Bow, Wyo., has been incorporated with a capital stock of $10,000 to supply electricity for lamps and motors in Medicine Bow. The incorporators are E. Anderson, S. H. Scofield, F. W. Shields and H. W. Richards.

Trade Publications

Glass Insulators.—The Brookfield Glass Company, 2 Rector Street, New York, has just issued Catalog A-56, which describes various types of glass insulators.

Reflectors.—Several types of reflectors are described and illustrated in a folder recently issued by the Holophane Works of the General Electric Company, Cleveland, Ohio.

Electric Washers.—The Pittsburgh Gage & Supply Company, Thirtieth Street and Liberty Avenue, Pittsburgh, Pa., has recently issued a bulletin which describes its electrically operated washing machine.

Lighting Glassware.—The Gleason-Tiebout Glass Company, 71 West Twenty-third Street, New York, is sending out a card which describes its "polycase" and "camia" glassware for nitrogen-filled lamps.

Battery-Charging Equipment. — The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., is sending out an illustrated folder which contains information on several types of control equipment for charging batteries.

Safety.—The Bureau of Safety, 112 West Adams Street, Chicago, Ill., has issued a bulletin concerning treatment for gas poisoning. It has excellent illustrations showing methods of "chaining" or grounding transmission lines.

Electric-Vehicle Batteries.—The United States Light & Heating Company, Niagara Falls, N. Y., has just issued the fifth edition of its Bulletin No. 102, which contains information on various types of storage batteries for electric vehicles.

Electric Accessories for Automobiles.—The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, has prepared a booklet which describes and illustrates a number of different types of electrically operated devices for automobiles.

Speed-Reducing Gear-Transmission Mechanisms for Electrical Machinery.—Various kinds of gear mechanism for reducing the speed of apparatus connected to electric machines are described in Bulletin No. 5, issued by the D. O. James Manufacturing Company, Chicago, Ill.

Lightning Protection for Railways.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a booklet entitled "Railway Lightning Protection," which describes several lightning arresters designed particularly for use with railway equipment.

Steam-Turbine-Driven Pumps.—The Kerr Turbine Company, Wellsville, N. Y., has just issued Bulletin No. 52, which contains information on its steam-turbine-driven pumps for water supply, boiler feeding, circulating condenser water, circulating water and heating systems, etc.

Electrical Slate.—A booklet designated as Price List No. 2, recently issued by the Davis Slate & Manufacturing Company, 608 East Fortieth Street, Chicago, Ill., describes several kinds of electrical slate, gives directions for repairing broken corners of slate slabs, and contains a price list of various types of slate.

Electric Ranges.—"Hughes 1915 Improvements" is the title of an illustrated folder recently issued by the Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill., which contains information on several types of electrically operated ranges and on an installation of electric cooking apparatus at the San Francisco Fair.

Construction News

New England

MANCHESTER, N. H.—The Manchester Trac., Lt. & Pwr. Co. is contemplating extensions and improvements to its system, involving an expenditure of $1,000,000, including the cost of the merger with the Nashua power service and increasing the output of the power plants in Manchester. The company is also building underground conduits.

SWANTON, VT.—The voltage of the transmission line between Swanton and the power plant at Highgate has been changed from 2300 volts to 6600 volts and a day service established for motors. Arrangements have also been completed with the Missisquoi Lt. Co., of Highgate Springs, for energy to be taken at the switchboard in the station. The Missisquoi company will begin work at once on the erection of its transmission line, which will be about 4 miles long. The town of Swanton is considering the construction of a new dam and flume at the municipal plant. C. J. Parker is superintendent.

CAMBRIDGE, MASS.—The Cambridge El. Lt. Co. has applied to the Board of Gas and Electric Light Commissioners for permission to issue $100,000 in additional capital stock, the proceeds to be used to pay outstanding indebtedness of the company and the cost of further additions to the plant.

READING, MASS.—At a town meeting held recently an appropriation of $12,000 was voted to make further extensions to the municipal electric-lighting service into Wilmington, North Reading and Lynnfield.

STERLING, MASS.—At a special town meeting held May 3 the citizens voted to appropriate $5,900 for extensions to the municipal electric-lighting system as follows: To the camp grounds at Sterling Junction, $2,600; extension to the Rowley Hill district, $2,000, and to the Chocksett District, $1,300.

Middle Atlantic

BATAVIA, N. Y.—The Genesee Lt. & Pwr. Co., of Batavia, has recently purchased equipment for an outdoor substation at Elba. The company will tap the transmission line of the Niagara, Lockport & Ontario Co. at Elba and install a commercial lighting and power service and also furnish street-lighting service, consisting of 31 street series lamps of 60 cp. H. K. Stein is superintendent.

EAST AURORA, N. Y.—The Board of Village Trustees is considering the installation of a new electric street-lighting system. The East Aurora El. Lt. Co. supplies the street-lighting service.

MORAVIA, N. Y.—The Moravia El. Lt., Ht. & Pwr. Co. expects to purchase immediately an oil engine of approximately 75 hp for the purpose of operating its plant during peak load and periods of low water. The company obtains its power from a hydroelectric plant. Lewis C. Reynolds is superintendent.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until May 17 for additions, alterations and repairs to the electric equipment in Public Schools 30, 32, 49, 53, 74, 109 and 151, borough of Manhattan. Blank forms, plans and specifications may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by the board of trustees of Bellevue and Allied Hospitals, 415 East Twenty-sixth Street, New York, until May 17 for completing the abandoned contract of the Tower Construction Co. for providing materials necessary for the masonry, carpentry, ornamental ironwork, structural steel and ironwork, metal work, electric work, gasfitting, etc., for the alterations to the power house and ambulance station of the Harlem Hospital, 136th and 137th Streets and Lenox Avenue. Blank forms and further information may be obtained at the office of the contract clerk, 400 East Twenty-ninth Street, New York.

SYRACUSE, N. Y.—Bids will be received by the Board of Commissioners, 305 City Hall, Syracuse, until June 1, for constructing and equipping a vocational high school building for which separate proposals will be received as follows: (1) General construction, including masonry, steel, carpentry and painting; (2) plumbing, gasfitting and vacuum cleaning equipment; (3) heating and ventilating; (4) electrical wiring and equipment; (5) elevators; (6) lockers; (7) lighting fixtures; (8) clocks and bells. Plans and specifications may be seen at the office of the board and at the office of Merrick & Randall, architects, 705 Sedgwick, Andrews & Kennedy Building, Syracuse.

WATERTOWN, N. Y.—The City Council has authorized the Board of Public Works to accept the proposal of the Northern New York Utilities, Inc., for lighting the streets of the city for a period of five years at $32,499 per year. Under the terms of the contract the company is to install a new street,-lighting system, to cost between $40,000 and $50,000.

BROOKVILLE, PA.—The Solar El. Co., of Brookville, is now installing Bruce-MacBeth gas engines, General Electric generators and accessories in its electric plant. The company is changing its system from direct current to alternating current. George W. Heber is secretary and general manager.

HARRISBURG, PA.—The State Water Supply Commission has granted the Harrisburg Lt. & Pwr. Co. permission to construct a coal wharf on Hargest Island in the Susquehanna River, opposite the city.

LEWISTON, PA.—The Borough Council is considering the proposal submitted by the Penn Central Lt. & Pwr. Co., of Altoona, for the installation of a new street-lighting system.

PATTON, PA.—The Town Council is considering the question of establishing a municipal electric-light plant. The Penn Central Co. now furnishes electrical service here.

PHILADELPHIA, PA.—The Philadelphia El. Co. has agreed to begin the installation of high-candle-power nitrogen lamps to replace the old arc lamps now in use. The first step will be the erection of 650 lamps on ornamental posts on South Broad Street Boulevard, the Northeast Boulevard, the Parkway and a number of streets in the residential sections.

SCRANTON, PA. — The Susquehanna County Lt. & Pwr. Co., of Scranton, is now operating the electric systems in the towns of Montrose and New Milford, having purchased the properties of the New Milford Lt. & Pwr. Co. and the Montrose Lt. & Pwr. Co. The Susquehanna company has erected a 17,000-volt transmission line from Susquehanna to Montrose, via New Milford. The steam plants in New Milford and Montrose have been closed down. F. J. Platt is treasurer and manager.

TITUSVILLE, PA. — Specifications are being prepared for improvements to the municipal electric-light plant, including the installation of two new 100-kva generators and the erection of 200 street-lamp fixtures for 400-cp and 600-cp type "C" lamps and all necessary appurtenances, except wire, cables and all overhead equipment.

WILKES-BARRE, PA. — Preparations are being made by the Duplan Silk Co. for the construction of a factory, 161 ft. by 420 ft., two stories high, including air-washing, heating, cooling and humidifying and sprinkler systems, electrical and power equipment. Bids will be received until May 20 at the New York office of the company, Fourth Avenue and Seventeenth Street. Ballinger & Perrot, 1328 Broadway, New York, are architects.

CAMDEN, N. J.—The Pub. Ser. El. Co. has submitted a proposal to the City Council providing for an extension of the work of placing its wires underground, the new work to extend from Cooper River to Tenth and Market Streets, and thence to Broadway and Kaighn Avenue. Under an agreement adopted some time ago the corporation planned to spend $250,000 a year for this work.

MILLVILLE, N. J.—The Council has engaged W. S. Temple, of Philadelphia, Pa., consulting electrical engineer, to prepare plans for the installation of an electric-lighting system in Millville.

PERTH AMBOY, N. J.—Bids will be received by the Board of Aldermen, Perth Amboy, until May 19 for construction of a muncipal electric-lighting plant as follows: (1) Construction of power station complete, including traveling crane; (2) oil engine, generators, switchboard, constant-current transformers, pumps, wiring of apparatus, electric lamps in building; (3) electrical work, including outside distributing system, both overhead and underground construction. Proposals may be submitted separately for each item, or a separate bid may be submitted for item No. 1 and a combined proposal for items Nos. 2 and 3. Plans and specifications may be seen at the office of Runyon & Carey, engineers, 845 Broad Street, Newark, where copies may be obtained upon deposit of $50.

WILMINGTON, DEL.—Plans are being prepared for the erection of an addition to the High School, to cost about $150,000. Provision is made for lighting the building throughout with electricity.

ST. MICHAELS, MD.—The Talbot Mfg. Co., of St. Michaels, has been granted a 20-year franchise to supply electricity for lamps and motors in the town. The company, it is reported, will enlarge the electrical plant in its packing factory to provide the additional service. New boilers and generators will be installed.

WHEELING, W. VA.—Bids will be received at the United States Engineering Office, Wheeling, W. Va., until June 2 for furnishing water turbines, air compressors, valve jacks, gate winches, etc., for dams Nos. 15 and 19, Ohio River.

WASHINGTON, D. C.—Bids will be received at the office of the electrical engineer, Treasury Department, Washington, D. C., until June 1, for furnishing and installing, complete, automatic weighing and recording scales in accordance with specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 16,617—An American consular officer in Spain reports that a business man in his district desires to represent American manufacturers of electrical goods. Correspondence and literature should be in Spanish. No. 16,619—This department is in receipt of a letter from a foreign commission merchant, who is now in the United States, stating that he desires to secure agencies for the sale of mining, mechanical and electrical machinery and instruments. He states that he desires exclusive agencies for the Netherlands and its colonies. No. 16,639—An American consular officer in Portugal transmits a report relative to an opportunity for the sale of electrical supplies. Electrical cartridge fuses may be examined at the above bureau and its branch offices. No. 16,642—This bureau is in receipt of a letter from a business man in the West Indies who desires to receive names and addresses of American manufacturers of machinery for sugar mills, railway materials, electrical machinery, etc. No. 16,646—An American consular officer in the Far East reports that an import and export firm has been organized in his district. The manager of the firm desires to communicate with American manufacturers and exporters of machinery, hardware, electrical goods and apparatus. No. 16,654—An American consular officer in Italy reports that a business man in his district is desirous of communicating with American manufacturers of electrical wire, switches, bulbs, etc. No. 16,693—A firm in Russia which has already placed orders in the United States for electric lamps informs an American consular officer that it desires to receive catalogs and price lists from American manufacturers of electric chandeliers, brackets, wall fixtures and table lamps; electric appliances, including heaters, sadirons, chafing dishes, boilers, hair curlers, cigarette lighters and novelties; electric wire; petroleum stoves for heating, petroleum ranges and small petroleum and alcohol stoves. Correspondence should be in Russian or French. No. 16,728—An American consular officer in Spain reports that a business man in his district desires to represent American manufacturers and exporters of kitchen utensils, dry batteries and toys. No. 16,741—A business man in Spain informs an American consular officer that he wishes to represent American firms which may care to sell electrical goods in that country. He states that he will also buy direct. Catalogs and correspondence should be in Spanish. No. 16,744—An American consular officer in Spain reports that a business man in his district desires to represent American manufacturers and exporers of electrical goods, hardware, etc. Correspondence should be in Spanish. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

North Central

CADILLAC, MICH.—A committee has been appointed to make investigations and secure estimates of cost of the installation of an ornamental lighting system in the business district.

ATHENS, OHIO.—The Public Utilities Commission has granted the Athens El. Co., recently organized to take over the telephone plant in Athens, permission to issue $75,000 in capital stock and $75,000 in three-year notes. Of the proceeds $25,000 will be used to make the initial cash payment on the telephone plant in Athens and $50,000 to be used for betterments and improvement to the system.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of

purchases and supplies, 511 City Hall, Cleveland, until May 20 for furnishing two steam-turbine-driven centifrugal feed pumps for the Division Avenue pumping station, Department of Public Utilities, division of water. Specifications may be obtained of the commissioner of water, 413 Superior Avenue, Cleveland.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, until May 21 for construction of a pavilion, complete, including electric wiring and lighting fixtures, in Washington Park. Specifications may be obtained at the office of the city architect, Room 420, City Hall, upon deposit of $5.

DAYTON, OHIO.—Negotiations have been concluded between the Oakwood St. Ry. Co. and the Dayton Pwr. & Lt. Co., whereby the latter will supply energy to operate the system of the Oakwood company. The power plant of the railway company on Brown Street will be abandoned.

MANTUA, OHIO.—The plant of the Mantua Ht., Lt. & Pwr. Co. has been closed permanently, leaving the village without electrical service. The installation of a municipal electric plant is under consideration.

MOUNT VERNON, OHIO.—The Ohio Lt. & Pwr. Co. has been awarded the contract for installing and maintaining cluster lamps on the public square.

OXFORD, OHIO.—Bids will be received by the board of trustees of Miami University, Oxford, until May 29, for alterations and additions to power plant of the university, including boiler and engine room extensions to power building, boiler, feedwater heater, vacuum-heating pumps, boiler-feed pumps, power equipment, changes and additions. W. L. Tobey, of Hamilton, is chairman of building committee; Walter G. Franz, of Cincinnati, is consulting engineer.

RITTMAN, OHIO.—Bids will be received by Vance Hickin, clerk of Council, until May 25 for construction of a sewage-treatment plant. The work includes construction of pumping station, with electrically driven centrifugal pumps, concrete sedimentation and dosing tanks, 1.25 acres of intermittent sand filters and earth dike. Bids to be submitted on the entire work. Plans and specifications, etc., are on file at the office of the clerk, or may be obtained from W. F. Peters, of Medina, engineer, or R. Winthrop Pratt, consulting engineer, Cleveland, upon deposit of $10.

TWINSBURG, OHIO.—The town of Twinsburg is negotiating with the Northern Ohio Trac. & Lt. Co., of Akron, for lighting the town.

XENIA, OHIO.—Experiments are being made by the Ohio Pwr. & Lt. Co. with new street lamps with a view of installing a new lighting system in Xenia. O. M. Hutchings, of Dayton, is general superintendent.

YOUNGSTOWN, OHIO.—In a decision handed down May 4 the Supreme Court sustained the Mahoning County Lt. Co.'s motion to dismiss the suit of the Youngstown & Sharon St. Ry. Co. to enjoin the lighting company from issuing $400,000 in stocks and $530,000 in bonds.

CLAY, KY.—The Franklin Furniture Co., of Clay, is in the market for an electric elevator (about 2 tons capacity) for furniture warehouse.

RUSSELL, KY.—The Council is considering the proposal submitted by the Ohio Valley El. Ry. Co., of Huntington, W. Va., to supply electricity in Russell. If granted a franchise, the company, it is understood, will extend its transmission to Russell to furnish the service.

STITHTON, KY.—The Greenup El. Co., of Stithton, it is reported, is planning to build a large pipe line to conduct water a distance of 3 miles to its power station, with sufficient fall to provide power to operate the generating machinery in its electric plant.

ASHLEY, IND.—The municipal electric-light plant was destroyed by fire on April 30, entailing a loss of about $4,000.

CHALMERS, IND.—At an election held April 16 the proposal to install an electric-lighting system was carried. The plant will be installed by a stock company. When completed it will probably be purchased by the town. T. C. Smith, of Chalmers, is engineer.

EAST GARY, IND.—The contract for fitting up the municipal electric-lighting plant in East Gary is reported to have been awarded to the T. G. Hamilton Co., of Gary, electrical engineer. Energy for operating the system, it is understood, will be secured from the Calumet Pwr. Co., a subsidiary of the Gary & Interurban R. R. Co.

ELKHART, IND.—Plans are being prepared for the installation of ornamental lamps on Main Street and seven blocks on Second Street. The plan provides for the erection of 80 single-unit standards (22½ ft. high), mounted with 400-cp lamps with refractors, and 30 posts (15 ft. high) carrying 100-cp lamps with refractors, maintained by underground wires. Contract for the work will be awarded about June 15. Vaughn, Meyer & Sweet, of Majestic Building, Milwaukee, Wis., are consulting engineers; L. M. Russell is city engineer.

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, Room 700, 900 South Michigan Avenue, Chicago, until May 20 as follows: (A) For construction of concrete and brick building, to be known as the Mohawk Street electrical substation; (B) for electrical equipment for the Mohawk Street substation. For details see proposal columns.

LANARK, ILL.—The City Council is considering the question of establishing a municipal electric-lighting plant in Lanark.

HIGHLAND, WIS.—The Village Board has granted the Mineral Point Pub. Ser. Co., of Mineral Point, a franchise to install an electric-lighting system in Highland. The transmission line will be extended from Montfort.

COHASSET, MINN.—Arrangements are being made to install an electric-lighting system in Cohasset. Electricity for operating the system will be supplied from the electric plant in the Cohasset woodenware factory. L. F. Stewart, of Hastings, is manager.

MARIETTA, MINN.—At an election to be held May 20 the proposal to establish a municipal electric-light plant will be submitted to the voters.

RUSSELL, MINN.—Bonds to the amount of $7,000 have been voted for the installation of a municipal electric-lighting plant.

ST. CLOUD, MINN.—All bids submitted for construction of an electric power plant in the State Reformatory, St. Cloud, have been rejected, and the plant will be constructed by day labor. Charles L. Pillsbury, of Minneapolis, is consulting engineer.

ALTA VISTA, IA.—Bids will be received by the town of Alta Vista until June 7 for the erection of an electric transmission line and distribution system in Alta Vista. For details see proposal columns.

BRITT, IA.—The Electric Light and Water Commission has engaged the Power & Engineering Co., of Minneapolis, Minn., to prepare plans and specifications for construction of dam on Wolk River.

CENTERVILLE, IA.—Preparations are being made by the Centerville Lt. & Trac. Co. for the erection of a transmission line to Cincinnati to furnish electricity for lighting in that town and to coal mines along the route. The equipment will include four 40-kw and one 20-kw and some smaller transformers, three outdoor substations, 600 cedar poles, 33 miles of No. 6 wire and 100 meters. N. R. Longnecker is engineer in charge.

ELDORA, IA.—Plans are being considered by the Iowa Lt. & Pwr. Co., of Eldora, for improvements to its electric plant, at a cost of about $50,000. The output of the steam plant will be doubled and a new power station erected.

EMMETSBURG, IA.—The proposal to grant a franchise to Mortimer Silverman, of Boston, Mass., to construct and operate an electric-light plant in Emmetsburg will be submitted to the voters at a special election to be held May 24.

ODEBOLT, IA.—The proposal to grant Messrs. Russell & Fry, of Corydon, a franchise to install and operate an electric-lighting plant in Odebolt will be submitted to the voters on May 25.

RIVERTON, IA.—The city of Riverton is contemplating the installation of a municipal electric-lighting plant, to cost about $7,000. Electricity for operating the system, it is understood, will probably be secured from the Shenandoah El. Ltg. Co., of Shenandoah.

SHELLSBURG, IA.—The installation of a municipal electric-lighting plant, to cost about $10,000, is under consideration. The Cass Interurban Co., it is reported, has also submitted a proposal to furnish electricity from Urbana to light the city.

SIBLEY, IA.—At an election held recently the proposal to install an electric-lighting system in Sibley was carried.

THORNTON, IA.—The installation of an electric-lighting plant in Thornton is under consideration.

VINTON, IA.—Bids will be received by the Board of Supervisors of Benton County, Vinton, until May 27 for construction of a County Home building for which separate bids will be received as follows: (A) General construction of building; (B) heating and plumbing; (C) wiring for lamps. Plans and specifications may be obtained from J. G. Ralston, architect, Waterloo, upon deposit of $15. Plans are also on file at the office of the supervisors and the architect.

WATERLOO, IA.—Improvements are contemplated to the power plant of the Waterloo, Cedar Falls & Northern Ry. Co., involving an expenditure of about $300,000. The plans provide for doubling the output of the plant and include the installation of a 4000-kw Allis-Chalmers turbine and three 500-hp Stirling boilers. C. D. Cass is general manager.

WELLMAN, IA.—The Wellman Lt. & Pwr. Co. has awarded contract for construction of power plant to the El. Const. & Mach. Co., of Rock Island, Ill. The equipment will consist of one 80-hp boiler, one 50-hp steam engine, one three-phase, 60-cycle, 2400-volt generator, switchboard equipment, four 7½-kva Kuhlman Electric transformers; 132 poles and about 5 miles of wire and General Electric meters. B. N. Jessen is interested in the company.

GALLATIN, MO.—Bonds to the amount of $17,000 have been voted, the proceeds to be used for extensions and improvements to the electric-lighting plant and waterworks system.

GRANBY, MO.—Improvements, it is reported, are contemplated by the Empire El. Co., of Joplin, to provide the Granby mining district with electrical service. The company proposes to enlarge the plant of the Neosho El. Lt. Co. and extend the transmission line from Diamon, a distance of 17 miles.

MONTROSE, MO.—Bids will be received by the city of Montrose until May 24 for furnishing material and construction of an electric-lighting plant and distribution system. Bids are to be submitted on the entire plant and distribution system or under four sections, as follows: Furnishing and installing oil-engine equipment in power house; furnishing and installing electrical equipment in power house; construction of power house; erection of pole-line distribution system. Plans and specifications are on file at the offices of the city clerk and Mayor of Montrose, and the office of E. T. Archer & Co., consulting engineers, New England Building, Kansas City, Mo., upon payment of $2 per set.

POPLAR BLUFFS, MO.—Bonds to the amount of $75,000 have been voted for the installation of a municipal electric-light plant, plans for which are nearly completed.

SPRINGFIELD, MO.—Plans are being considered, it is reported, by the Board of Regents of the Normal School at Springfield for installation of an isolated electric light and power plant at the Normal School.

GARDEN CITY, S. D.—The Trustees of the village of Garden City have granted G. F. von Egeler a franchise to construct and operate an electric-light plant here.

WESSINGTON, S. D.—Plans are being considered by R. W. Stoner and C. J. Stoner, of Iroquois, it is reported, for the installation of an electric-lighting plant in Wessington.

BROCK, NEB.—The citizens of Brock have voted to issue bonds for the purpose of erecting an electric transmission line from Auburn to Brock, a distance of 12 miles. Electricity will be secured from the Auburn plant and will be distributed by the municipality for street-lighting and commercial purposes.

JANSEN, NEB.—The State Railway Commission has granted the Jansen Lt. & Pwr. Co. permission to issue $5,500 in capital stock, the proceeds to be used for construction work. Electricity for operating the system will be obtained from the plant in Fairbury.

KIRWIN, KAN.—Bonds to the amount of $12,000 have been voted for the installation of a municipal electric-lighting plant.

PRATT, KAN.—The City Commission has awarded the contract for the construction of the municipal electric-lighting plant to the Connor Const. Co., of Kansas City, for $47,262.

Southern States

CONCORD, N. C.—The Board of Water and Light Commissioners expects to purchase a carload of poles. L. A. Fisher is treasurer and superintendent.

WINNSBORO, S. C.—The Board of Public Works expects to erect within the next three months a 22,000-volt primary line from the plant of the Parr Shoals Pwr. Co. on the Broad River to Winnsboro; also to erect a substation and establish a 24-hour service. T. R. Ellison is superintendent.

ADEL, GA.—The city of Adel is contemplating lighting 1½ miles of the proposed "Dixie Highway." T. R. Sutton is superintendent of the municipal electric-light plant.

ROME, GA.—The City Commissioners are considering the question of installing a

municipal electric-light plant to supply electricity for lighting the streets and public buildings.

SOPERTON, GA.—Plans are being considered for the installation of an electric-lighting plant in Soperton.

MERIDIAN, MISS.—The Meridian Lt. & Ry. Co has closed a contract to furnish energy for 527 hp in motors for the Lauderdale cotton mills, completing equipment of the mills for electrical operation. They now use 692 hp of electrical energy.

BATON ROUGE, LA.—The Baton Rouge El. Co., it is reported, contemplates the construction of a new power plant on Government Street, at the Louisiana Ry. & Navigation intersection, to cost about $200,000. Donald Stewart is manager.

OBERLIN, LA.—The installation of a municipal electric-lighting plant in Oberlin is under consideration. A committee, with Mayor W. D. Stockwell as chairman, has been appointed to engage an engineer.

ABILENE, TEX.—The Abilene Gas & El. Co., controlled by the American Pub. Corpn., of New York, N. Y., it is reported, is contemplating erecting transmission lines from Abilene to Cisco, Clyde, Putnam, Baird and possibly other cities, to furnish electrical service in those places. The proposed line will be 48 miles long.

CORPUS CHRISTI, TEX.—The construction of a system of interurban electric railways in this section and a local railway system in Corpus Christi is under consideration by J. H. Caswell, of San Diego, and associates. The interurban lines will run from Corpus Christi to Kingsville, via Bishop, and from Corpus Christi to Portland; also from Corpus Christi to Oso. The erection of a large power plant is contemplated in connection with the project.

GONZALES, TEX.—Within the next two months the Citizens' El. Lt. & Pwr. Co., of Gonzales, expects to complete its dam on the Guadalupe River, which will develop about 800 hp. T. H. Spooner is secretary and manager.

HOUSTON, TEX.—The Houston, Richmond & Western Trac. Co., recently organized with a capital stock of $50,000, proposes to construct an interurban electric railway between Houston and Richmond, a distance of about 35 miles. The plans provide for the construction of an electric generating plant. E. Kenneday, W. W. Thomas and J. C. Eganhouse are among the incorporators.

HUBBARD CITY, TEX.—Within the next 30 days the Union Central Lt. & Ice Co., of Hubbard City, expects to erect 5000 ft. of transmission line and to purchase several electric meters, poles, wire, etc.; also wiring supplies and material. W. A. Bass is president and manager.

KERRVILLE, TEX.—Within the next 30 days the Kerrville El. Lt., Ht. & Pwr. Co. expects to purchase one boiler of from 80-hp to 100-hp rating. The property has recently been purchased by Messrs. Peterson & Holdsworth. T. Holdsworth is manger.

LONGVIEW, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 2 for construction complete (including mechanical equipment, interior lighting fixtures and approaches) of the United States post office at Longview. Drawings and specifications may be obtained from the above office or from the custodian of site at Longview.

NORTH PLEASANTON, TEX. (not a post office).—The installation of an electric light and power plant and ice factory in North Pleasanton, at a cost of about $40,000, is under consideration. L. B. Myers, of El Reno, Okla., and associates are interested in the project.

SEQUIN, TEX.—Extensions and improvements, it is reported, are contemplated by the Seguin El. Lt. & Pwr. Co., including the installation of a 187-kva, three-phase, 60-cycle, 2300-volt (waterwheel type) generator, exciter and switchboards, two 150-hp vertical waterwheels, transmission machinery, building and penstocks.

TEMPLE, TEX.—At an election to be held June 1 the proposal to issue $40,000 for the installation of an electric fire-alarm system and the erection of two fire stations will be submitted to the voters.

VICTORIA, TEX.—Bonds to the amount of $40,000 have been voted for the installation of a municipal electric-lighting plant.

Pacific States

ENUMCLAW, WASH.—The Enumclaw Wtr. & Lt. Co. has been granted a franchise to install an electrical distribution system to furnish electrical service here.

MORTON, WASH.—The property of the Morton El. Co. has been purchased by C. O. Smith, of Pe Ell, Wash. The new owner, it is said, contemplates extensive improvements and extensions to the system.

SEATTLE, WASH.—The Commissioners of King County have granted G. A. Collins a franchise to supply electricity to Vashon and Maury Islands. A company has been organized by Mr. Collins for the purpose of building an electric plant to furnish the service. The cost of the proposed plant is estimated at $20,000, work on which will begin immediately.

SEATTLE, WASH.—George E. Tilden, of the Seattle Bond & Brokerage Co., Hoge Building, Seattle, is reported to be interested in a project to furnish electricity for lamps and motors in cities and towns in Chehalis and Pacific Counties. It is proposed to erect a plant at or near Lake Cushman and erect transmission lines forming a loop running through Shelton and the cities of Chehalis and Pacific Counties, back through Centralia and Olympia and to Shelton and the power plant.

TACOMA, WASH.—The city attorney has been instructed by the City Council and Mayor Fawcett to draft an ordinance authorizing the Mayor and controller to consummate the pending deal between the city of Tacoma and the Central Heating Co. for the proposed steam auxiliary to the municipal hydroelectric power plant. The Central Htg. Co. contemplates an expenditure of $250,000 the first year. By terms of the agreement the city will have the privilege of installing generators in the steam-heating plant. The cost of installing the generators in the proposed plant is estimated at about $75,000. The offer of the Puget Sound Trac., Lt. & Pwr. Co. (for details see issue of May 8) will not be affected by the above action.

PORTLAND, ORE.—Improvements and betterments are contemplated by the Portland Ry., Lt. & Pwr. Co. to its system, involving an expenditure of about $1,250,000.

ALAMEDA, CAL.—The Electric Light Commission is contemplating extending the municipal electrical service to Bay Farm Island.

ESCONDIDO, CAL.—The City Council has decided to call a special election to submit to the voters the proposal to issue bonds to purchase the property of the Escondido Utilities Co.

LAKEPORT, CAL.—The Mount Konocti Lt. & Pwr. Co., of Lakeport, has petitioned the State Railroad Commission for authority to issue $25,000 in capital stock, part of the proceeds to be used to pay outstanding indebtedness of $15,500 and the remainder for extensions to its plant and system.

LOYALTON, CAL.—The Loyalton El. Lt. Co. has been granted permission to close down its plant May 25. The company has agreed to sell any part of the equipment at prices set by the engineer of the commission.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 10 for a conduit and wiring system in the United States mint at San Francisco, Cal. For details see proposal columns.

SAN FRANCISCO, CAL.—Plans are being considered by an organization of business men for equipping the Ocean Shore Railroad for complete electrical operation and the construction of new stations. M. B. Johnson has been chosen president of the organization.

BOISE, IDAHO.—If the Black Canyon irrigation district in southwestern Idaho, comprising 150,000 acres of land, can dispose of 15,000 hp of electrical energy to cities and towns in that section of the State, the project will be financed. It is proposed to erect a 15,000-hp electric generating plant on the Payette River at the head of the Black Canyon. The cost of the project is estimated at $5,000,000. C. L. Tallmadge, 37 Wall Street, New York, N. Y., is interested in the project.

MOSCOW, IDAHO.—The State Board of Education, it is reported, is contemplating the installation of a small electric light and power plant to supply electricity for the purpose of lighting the buildings and campus of the Agricultural College.

OGDEN, UTAH.—Extension of the interurban lines of the Ogden, Logan & Boise Ry. Co. to connect Brigham City, of the Ogden division, with Wellsville, of the Logan division, has been authorized, work on which will begin at once. Ultimately the railway will connect Ogden and Preston, Idaho.

FORT HUACHUCA, ARIZ.—Bids will be received at the office of the constructing quartermaster, Fort Huachuca, until June 9 for furnishing materials and machinery and for construction complete of an electric-lighting and refrigerating plant and installing interior and exterior wiring system. For detail see proposal columns.

MIAMI, ARIZ.—The City Council has decided to call an election on June 15 to submit the proposal to issue $130,000 in bonds for municipal improvements, of which the proceeds of $30,000 will be used for the installation of an electric-light plant.

PHOENIX, ARIZ.—The Arizona Eastern R. R. Co., it is reported, is contemplating equipping its division between Phoenix and Mesa for electrical operation. If this is done, a spur track will probably be constructed through the portion of Mesa.

ANACONDA, MONT.—A resolution has been adopted by the City Council for the installation of an ornamental lighting system on Main Street, to cost about $6,000. Bids, it is understood, will soon be asked for same.

RENO, NEV.—The City Council is considering the question of issuing $750,000 in bonds for the installation of a municipal electric-light plant and water-works system.

LORDSBURG, N. M.—Within the next 30 days the Lordsburg Pwr. Co. expects to purchase a 75-hp fuel-oil engine and a three-phase, 60-cycle, 2200-volt generator, directly connected. W. Y. Ritter is manager.

ROSWELL, N. M.—The Roswell Gas & El. Co. is installing about 150 ornamental lamp standards (three and five lamps), using safety steel-taped cable, in the business district. Material has all been purchased. C. M. Einhart is superintendent.

ROSWELL, N. M.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 2 for an oil-burning plant for heating boilers in the United States post office at Roswell, N. M. For details see proposal columns.

SANTA FE, N. M.—Application has been made to the state engineer of New Mexico by the Rio Grande Dam, Lt. & Pwr. Co., of Philadelphia, Pa., for permission to construct a dam 100 ft. high in White Rock Canyon, between Cochiti and Buckman, and to use part of the flow of the Rio Grande River for the purpose of developing electrical energy for industrial purposes. Electricity generated at the proposed plant will be transmitted to Albuquerque, Santa Fé, Las Vegas and other towns. Energy will also be supplied to irrigating plants in the Estancia Valley.

Canada

KELOWNA, B. C.—The City Council is considering the question of establishing a municipal electric-light plant, to cost about $120,000. The proposal will probably be submitted to the voters in the near future.

NIAGARA FALLS, ONT.—The Canadian Niagara Pwr. Co., of Niagara Falls, it is reported, is contemplating improvements to its plant in Niagara Falls, costing about $3,000,000, which will include a new forebay to combat ice during the winter. It is proposed to take water from the river through large intake tubes. A dam will be built in the river to raise the water sufficiently to submerge the intake tubes.

Miscellaneous

HAVANA, CUBA.—Announcement has been made that permission has been granted for the installation of electric light and power plants in Cuba as follows: Francisco Arrendondo y Bentancourt, at Jobabo, in the municipal district of Victoria de las Tunas; Dorin do Vâzquez in the town of Florida, Province of Camaguey; also Perfecto Rodriguez in the town of Florida. In each case the concession will be rescinded if the plant is not in operation within a year from the date of concession.

PANAMA.—Bids will be received at the office of the general purchasing office, the Panama Canal, Washington, D. C., until May 27 for ice and refrigerating plant, motor-driven lathes, drill presses, shapers and sensitive drills, etc. Blanks and general information relating to this circular (No. 924) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

SANTO DOMINGO, WEST INDIES.—The Municipal Council has decided to contract for a loan for the installation of a new electric-light plant. A committee of three has been appointed to look after details of the proposed plant. The contract entered into with S. Michela for furnishing electricity for lamps and motors in June, 1914, has been rescinded.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 4, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,137,729. Electric Motor; Homer E. Adams, Fort Worth, Tex. App. filed Jan. 19, 1914. Strong starting torque on alternating current or direct current.

1,137,806. Process of Producing Acid Monocalcium Phosphate; R. Stewart, Logan, Utah. App. filed June 17, 1914. Subjects phosphate rock to smelter smoke in prisms of steam and then subjects solution so obtained to an oxidizing electric current.

1,137,831. Electric-Lighting System for Automobiles; J. Bijur, New York, N. Y. App. filed Aug. 26, 1911. Efficient and practical current supply.

1,137,834. Apparatus for Cutting, Welding and Brazing Metals; F. M. Bowers, Chester, Pa. App. filed Aug. 26, 1914. Combined action of electric arc and a blast of oxygen.

1,137,840. Overload and Reverse-Current Relay; F. Conrad, Swissvale, Pa. App. filed May 22, 1909. Movable member is caused to move at substantially uniform rate when initial actuating force exceeds a predetermined value.

1,137,848. Electric Locomotive; G. M. Eaton, Pittsburgh, Pa. App. filed Aug. 11, 1913. Running-gear frame constructed to prevent "skewing."

1,137,865. Telephone System; E. E. Kleinschmidt, New York, N. Y. App. filed Feb. 25, 1910. Selective signaling of local stations.

1,137,866. Method of Regulating the Speed of Alternating-Current Motors; O. Knöpfli, Zurich, Switzerland. App. filed April 10, 1911. For single-phase commutator motors provided with working and exciting brushes.

1,137,873. Metering System; P. M. Lincoln, Pittsburgh, Pa. App. filed Jan. 7, 1911. Opens circuit when the integrated amount of power exceeds predetermined amount in a given time.

1,137,874. Process of Leaching Ores; J. A. McCaskell, Salt Lake City, Utah. App. filed June 2, 1914. Producing chlorine gas electrolytically.

1,137,875. Switch; O. E. McCoy, Baltimore, Md. App. filed April 13, 1912. For connecting sending and receiving instruments of wireless system to aerial at will.

1,137,894. Printing-Telegraph Sending Apparatus; F. D. Pearne, Chicago, Ill. App. filed March 22, 1909. Second key may be depressed before first depressed key returns to normal raised position.

1,137,908. Centrifugal Circuit-Breaker; C. F. Rumold, Berea, Ky. App. filed March 12, 1913. Includes a rotating mercury container.

1,137,929. Telautographic Apparatus; G. S. Tiffany, Summit, N. J. App. filed April 2, 1912. Uses magnets of the solenoid type.

1,137,931. Cable Armor Joint; W. P. Traver and L. F. Theis, San Francisco, Cal. App. filed Dec. 23, 1913. Strain-carrying joint for submarine cables.

1,137,954. Lighting Fixture; J. R. Cravath, Chicago, Ill. App. filed Nov. 14, 1913. Combined direct and indirect light.

1,134,964. Method of and Means for Producing Electrically Charged Particles; R. H. Goddard, Worcester, Mass. App. filed April 26, 1913. Electrified particles move continuously within confined space until they strike molecules or particles of gas or vapor.

1,137,992. Spark-Plug Attachment; R. K. McDougal, Lincoln, Neb. App. filed March 11, 1912. For short-circuiting the plug.

1,138,029. Signal Device; S. T. Warner, New York, N. Y. App. filed Aug. 23, 1913. Automobile direction indicator.

1,138,074. Connector; W. A. Bonnell, Brooklyn, N. Y. App. filed Sept. 29, 1910. For junction boxes.

1,138,087. Railway Signal; J. P. Coleman, Edgewood Borough, Pa. App. filed Aug. 5, 1912. Based signal motor and holding device.

1,138,103. Music Player; D. J. Hauss and A. Dom, Aurora, Ind. App. filed Aug. 12, 1909. Electrically actuated.

1,138,113. X-Ray Apparatus; S. T. Hutton, Chicago, Ill. App. filed March 7, 1911. Rectifying switch.

1,138,124. Indicator; D. O. Lawrence, Columbus, Neb. App. filed July 22, 1910; renewed Oct. 10, 1914. For slot pay station.

1,138,147. Method of Tuning Telephone Receivers; H. J. Power, Everett, Mass. App. filed Feb. 5, 1914. Varies the degree of saturation of the cores of the receiver magnet and maintains reluctance of the magnetic circuit approximately constant.

1,138,154. Electric Resistance Welding; A. M. Stanley, Lynn, Mass. App. filed Jan 23, 1915. Has supplementary electrodes for preparing the welded elements for the welding electrodes.

1,138,162. Vapor-Electric Device; E. Weintraub, Lynn, Mass. App. filed March 13, 1913. High-pressure arc lamp.

1,138,163. Vapor-Electric Device; E. Weintraub, Lynn, Mass. App. filed March 13, 1913. High-pressure lamp of increased efficiency and range of operation.

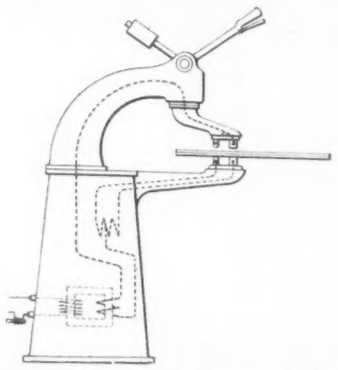
1,138,170. Transformer Protector; O. B. Allgood, Blocton, Ala. App. filed March 11, 1913. Prevents a three-phase motor from running single-phase.

1,138,174. Telephone-Exchange System; G. Babcock, Rochester, N. Y. App. filed Jan. 22, 1910. Service metering system.

1,138,175. Telephone System; G. Babcock, Rochester, N. Y. App. filed March 6, 1911. Party-line message meters.

1,138,184. Suspension Device for Trolley Wires; G. H. Bolus, Mansfield, Ohio. App. filed Feb. 20, 1914. Flexible support.

1,138,186. Grounding Device; L. S. Brach, New York, N. Y. App. filed Dec. 6, 1912. Intercepts and retains moisture soaking down through the earth.



1,138,154—Electric Resistance Welding

1,138,212. Electric Switch; J. H. Hall, Cleveland, Ohio. App. filed Sept. 26, 1910. Magnetically operated motor-starting switch.

1,138,220. Storage Battery; R. Hurley, Hoboken, N. J. App. filed Dec. 28, 1912. High-voltage efficient lead-zinc battery.

1,138,221. Electrolyte; R. Hurley, Hoboken, N. J. App. filed Dec. 28, 1912. Sulphate of lead, sulphate of zinc, sulphuric acid and water.

1,138,222. Individual or Group Cut-Outs for Electrical Devices; C. Johnston and C. Johnston, Memphis, Tenn. App. filed March 21, 1911, renewed Sept. 29, 1913. Distant control means for lamps, etc.

1,138,224. Electrical Switch Key; W. Kaisling, Chicago, Ill. App. filed June 19, 1913. Compact multiple push-button structure.

1,138,254. Dynamo-Electric Machine; O. F. Sire, Paris, France. App. filed Jan. 31, 1911. Utilizes translatory movement of a coil movable in a magnetic field.

1,138,255. Intercommunicating Telephone System; H. T. Slee, Warwick, R. I. App. filed Dec. 4, 1913. Wiring and switches for a test board.

1,138,258. High-Tension Electric Terminal; A. A. Stupe, Chicago, Ill. App. filed March 23, 1910. For coil boxes, etc.

1,138,279. Trolley Contact; A. H. Caven, Youngwood, Pa. App. filed May 7, 1914. For diverting current from trolley to operate a signal.

1,138,283. Telephone-Call Register; W. G. Dodge and C. H. Leave, Boston, Mass. App. filed March 20, 1914. Keeps visual record of calls made.

1,138,286. Dynamo-Electric Machinery; L. V. Grillet and J. B. Truchetet, Paris, France. App. filed Jan. 9, 1914. For car lighting, armature being shifted axially to change circuit connections.

1,138,287. Safety Switch for Electric Train Controls; R. Hamlen, Oakland, Cal. App. filed March 31, 1914. Prevents starting of train until proper air-brake valve is operated.

1,138,292. Locking Lamp; H. Hubbell, Bridgeport, Conn. App. filed Feb. 1, 1913. Lamp base cannot be unscrewed from socket without destroying usefulness of lamp.

1,138,293. Locking Lamp; H. Hubbell, Bridgeport, Conn. App. filed April 9, 1913. Special lamp-base structure.

1,138,299. Electrical Driving System; H. C. Leake, Altrincham, Eng. App. filed June 6, 1910. For warship turrets.

1,138,334. Police Signal Station; K. J. Wallace, Brockton, Mass. App. filed May 22, 1914. Post carrying telephone, handcuffs, etc.

1,138,341. System of Distribution; R. B. Williamson, Milwaukee, Wis. App. filed Sept. 30, 1909. For maintaining loads on generator constant.

1,138,362. Heating Device; C. E. Egan and W. E. Mayer, Cincinnati, Ohio. App. filed Nov. 26, 1913. Burner and automatic igniting means.

1,138,363. Primary Battery; D. Elmes, Orange, N. J. App. filed Oct. 3, 1914. Electrode plate which indicates approximate amount of energy expended and amount still available.

1,138,366. Safety Limit Switch; H. A. Everett, Haddon Heights, N. J. App. filed Aug. 27, 1910. Special latch construction.

1,138,389. Attachment for Telephone Transmitters; T. Luby, Philadelphia, Pa. App. filed Aug. 15, 1914. Closure which can be locked over mouthpiece of transmitter.

1,138,400. Apparatus for Electrolysis of Alkaline Chlorides; K. Ochs, Berlin-Charlottenburg, Germany. App. filed Nov. 13, 1914. Uses horizontal diaphragm and prevents formation of hypochlorite.

1,138,406. Electrically Operated Time Switch; J. W. Pennewill and M. R. Buchanan, Silver City, N. M. App. filed July 23, 1913. For turning out lights in refrigerating plant, etc.

1,138,441. Trouble Detector for Spark Plugs; G. M. Beard, Pleasant Lake, Ind. App. filed April 3, 1914. Readily attachable and shows whether each plug is operating properly.

1,138,445. Terminal Connection for Spark Plugs; J. P. Blauvelt, Nyack, N. Y. App. filed Oct. 21, 1914. Prevents loss of nut which holds the terminal clip to the spark plug.

1,138,471. Advertising Device and the Like; H. K. Harris, Runwell, Wickford, Eng. App. filed March 17, 1911. Means controllable from a distance for displaying a number of intelligible signs.

1,138,512. Sparking Device for Engines; W. M. Stempel, Fort Madison, Ia. App. filed May 16, 1912. An electrode make-and-break.

1,138,513. Electric Meter; W. M. Stempel, State College, Pa. App. filed Feb. 27, 1913. For serving customers with energy at reduced rates during certain hours and at full rates during other hours.

1,138,519. Process of Manufacturing Peroxide of Hydrogen; W. Weber, Dusseldorf, Germany. App. filed Feb. 26, 1914. Reduces oxygenous gases dissolved in electrolyte to hydrogen peroxide at a copper amalgam cathode by electrolysis.

1,138,520. Process of Manufacturing Peroxide of Hydrogen; W. Weber, Dusseldorf, Germany. App. filed Feb. 26, 1914. Amalgamated silver cathode.

1,138,522. Electrical Ignition Apparatus; E. C. Wilcox, Meriden, Conn. App. filed June 18, 1914. Improved interrupter construction.

1,138,543. Signaling Apparatus; H. C. Davis, New York, and E. D. Chadwick, Winchester, Mass. App. filed June 15, 1909. For checking night watchmen.

1,138,560. Automatic Speed Control for Vehicles; A. G. Helfer, New York, N. Y. App. filed Sept. 12, 1913. Speedometer interrupts magneto circuit when vehicle's speed exceeds a certain limit.

1,138,569. Ignition System; D. B. Hughes, Cleveland, Ohio. App. filed April 27, 1910; renewed Sept. 25, 1914. Condenser for each spark plug.

1,138,577. Controlling Device for Use in Automobiles; V. Lancia, Turin, Italy. App. filed July 31, 1913. Lights, etc., are controlled from steering wheel.

1,138,593. Water Heater; D. H. Mosteller, Chicago, Ill. App. filed May 4, 1914. Constructed to heat water quickly or to produce steam.